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CHINA

Situation and Outlook Series



China's booming feed industry has grown
15 percent a year since 1990.





INTERNATIONAL AGRICULTURE AND TRADE REPORTS

CHINA

Situation and Outlook Series

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Department of
Agriculture

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March 2000

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Preface

This report focuses on China's feed industry, building on the 1998 report that highlighted China's livestock sector. The report begins with a review of recent developments in China's overall economy, then assesses the current situation for China's major agricultural sectors—grains, oilseeds, animal products, and cotton. This economic and agricultural backdrop sets the stage for a detailed examination of livestock feeding practices in China and their implications for the feed manufacturing industry.

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Despite Generally Sluggish Economy, China's Manufactured Feed Industry Poised for Long-term Growth

China's economic growth is slowing, primarily due to reduced domestic consumer demand. Growth in China's gross domestic product dropped to 7.1 percent in 1999, the slowest since 1983. Exports, which had risen 21 percent in 1997 and an astonishing 15.5 percent a year on average during 1980-97, came to a near standstill in 1998 and rose only modestly in 1999. East and Southeast Asian countries, which formerly purchased about 60 percent of China's exports, were hurt severely by the Asian financial crisis. Besides cutting back on their own imports from China, many of these countries devalued their currencies, making their exports more competitive with similar products from China.

China's economy is in a period of soft consumer demand for goods and services because consumer confidence has been shaken by government reform initiatives to eliminate housing subsidies, streamline government employment, and reduce benefits under the government-provided healthcare system. Domestic and foreign demand for China's products declined, and many of its rigid, state-run industries failed to adequately adjust their output mix. Excess supplies of unwanted goods led to almost 2 years of price deflation.

In contrast to the slowdown in the general economy, China is expected to have a slightly larger grain harvest for the 1999/2000 crop year. USDA currently forecasts production of 115 million tons of wheat, 201 million tons of rough rice, and 128 million tons of corn. On the policy front, the "governor's grain bag policy" continues to pressure provincial officials to use economic incentives and their administrative powers to push farmers to grow more grain despite large stocks and low prices. The surplus of domestically produced grain led to sharply reduced grain imports in 1998/99, when China imported only 0.8 million tons of wheat—the least since 1960. Wheat imports are forecast to remain low in 1999/2000. Grain exports, on the other hand, have surged. Together, corn and rice exports are projected to increase 79 percent from 1998/99 to 10.9 million tons in 1999/2000. Starting in 2000, price supports have been reduced or eliminated for low quality grains. Previously, more uniform procurement prices encouraged farmers to produce unwanted low quality grain that accumulated in government warehouses.

Seeking to capture the value added in oilseed crushing, China re-imposed the 13-percent value added tax on soymeal imports. This move is expected to shift import demand from soymeal to soybeans. China's soybean production is projected to fall to 14 million tons in 1999/2000. Imports of soybeans are estimated to increase 1.2 million

tons to 5.0 million in 1999/2000, while soybean meal imports declined 900,000 tons to 0.5 million. Total protein meal available to the feed manufacturing industry is not expected to change, however, as meal produced from crushing the additional soybean imports will replace the decline in direct meal imports.

Consecutive bumper grain harvests, the resulting low grain prices, and significant imports of protein meals contributed to continued growth in China's livestock product output in 1998. Meat production rose 6.5 percent. However, pork, poultry meat, and egg consumption slowed as income growth dampened and export demand remained limited to nearby Hong Kong, Japan, and Russia. Meat product prices fell sharply in 1998 and 1999. Over the 20-month period ending in August 1999, pork retail prices decreased 23 percent and live hog prices dropped 27 percent. The weakness in the livestock sector has contributed to reduced demand for manufactured feed, especially ready-to-use compound feed.

As China's meat production shifts from a sideline to a full-time occupation, meat quality and feeding efficiency are increasingly important goals for livestock producers. Based on a recent survey, about 80 percent of pork production comes from hogs raised as a sideline by traditional "backyard" producers, 15 percent comes from specialized farm households where hog production is the main occupation, and 5 percent comes from large-scale commercial operations. Specialized households and commercial operations rely on manufactured feeds and are responsive to changes in grain prices to a larger degree than backyard producers, who continue to use significant amounts of homegrown grains and farm byproducts. Using "free" household labor to feed animals largely with "free" farm byproducts can be done only on a very small scale—typically one or two hogs at a time (rarely more than five), or up to a few dozen chickens. Thus growth in China's animal product output will depend mostly on expansion of the specialized farms and large-scale commercial operations.

China's feed manufacturing industry is now the world's second largest. Output totaled 66 million tons in 1998, after growing an average of 15 percent a year since 1990. In gradual steps from 1975 to 1985, the government reversed its strategy of central planning, largely privatizing agriculture and then embarking on a course of liberalizing the economy as a whole. Incomes began to rise rapidly. Demand for meat, fish, and eggs increased. In the early 1980s, China's leaders recognized that increased use of manufactured feed would support the livestock industry, which in turn would improve farm income, provide rural employment, and improve the nutritional level of consumers. Therefore the government provided important tax breaks to

feed mills, fostered research and technology exchanges with foreign firms, and implemented long-term feed development plans. As a result, China went from virtually no modern feed mills in 1975 to its current prominent position.

Economic difficulties at home and abroad reduced China's meat production and consumption in 1999, causing short-term uncertainty for the feed manufacturing industry. However, the industry is maturing, producing specialized compound feeds that provide complete nutrition for particu-

lar kinds of animals and fish, as well as significant amounts of premixes and concentrate feeds for farmers to mix on site with locally available grains, protein meals, and fiber. The inclusion rate of soybean meals and other protein meals has never been higher, because of low prices and abundant supplies. In the long run, prospects will remain positive for U.S. exporters of grains and oilseeds, as China's livestock and feed sectors respond to long-term growth in demand.

China Fights Deflation in 1999

China's exports and foreign direct investment stopped growing in 1998 and fell in the first 6 months of 1999. Deflation is a highly visible symptom of China's most pressing problem: a lack of demand, at home and abroad, for the goods and services it produces. Consumer prices had been falling for 24 consecutive months by the end of September 1999. The recovery of the Asian economy started to stimulate China's exports in the third quarter of 1999. China's government has also adopted an expansive fiscal policy to boost the domestic economy. Although huge public investment in infrastructure may stimulate growth in heavy industries, the massive scale of these projects imposes a considerable risk of inefficiency. [Xinshen Diao, 202-862-8113; x.diao@cgiar.org]

Last year, the repercussions of the Asian financial crisis on China's economy became significant. The officially reported GDP growth rate fell from 8.8 percent in 1997 to 7.8 percent in 1998 (table 1), short of the targeted 8 percent, even though the central government for the first time adopted an expansive fiscal policy with huge state investments in infrastructure.

Hampered by reduced import demand in East Asian markets due to the economic crisis there, the value of China's exports grew only 0.5 percent in 1998, down from 20.9 percent in 1997 and the slowest growth since 1983.

Finding customers for its products is now China's most pressing problem. With sluggish domestic demand and falling exports, the rate of economic growth is expected to decline further in 1999. The government's goal for 1999 GDP growth is 7 percent.

Table 1--China's macroeconomic indicators, 1997-98

Indicator	Units	1997	1998
Population	Million	1,236	1,248
GDP	US\$ billion	902	961
GDP growth	Percent	8.8	7.8
Change in CPI	Percent	0.8	-2.6
Currency in circulation	US\$ billion	123	135
Central government:			
Expenditure	US\$ billion	111	130
Revenue	US\$ billion	104	119
Budget deficit	US\$ billion	7	11
Fixed asset investment	US\$ billion	301	344
Exports	US\$ billion	183	184
Imports	US\$ billion	142	140
Exchange rate	Yuan per US\$	8.29	8.28

Sources: *China Statistical Yearbook* and *China Statistics Abstract*.

Exports and Foreign Direct Investment Decline

Exports have fueled China's economic growth over the last two decades. Rising exports contributed roughly a quarter of GDP growth in recent years. During 1980-97, China's GDP grew an average of 9.9 percent each year, while its exports grew an astonishing annual average of 15.5 percent (figure 1). As a result, the ratio of exports to GDP rose from 6 percent in 1980 to 20.3 percent in 1997 (figure 2).

The decline in China's export growth in 1998 was mainly due to weak import demand from its Asian neighbors, which had purchased about 60 percent of China's total exports in recent years. Held back by currency devaluation in most East Asian countries and a sluggish Japanese economy, China's total exports to Asia fell 9.9 percent in 1998.

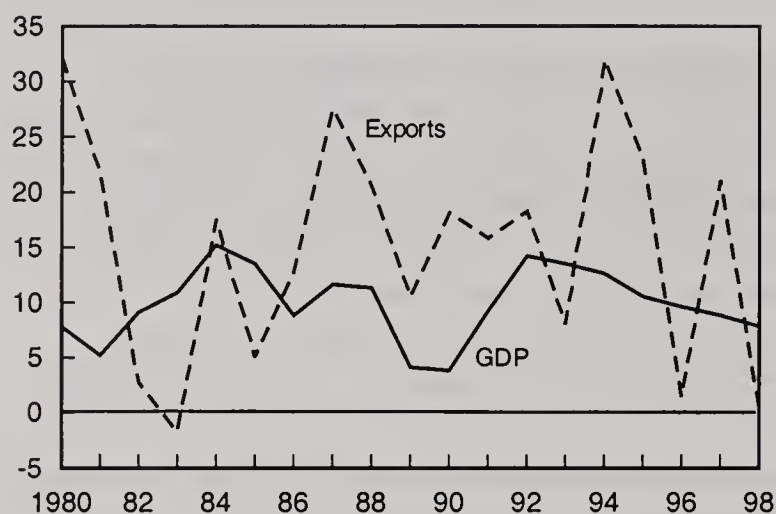
Low world agricultural prices and weak Asian markets caused the value of China's agricultural exports to decline about 10 percent in 1997 to \$13 billion in 1998. Corn exports were down 2.7 million tons and rice exports down 0.9 million tons in the 1998/99 crop year compared to the previous year.

China's exports of both agricultural and nonagricultural goods in the first half of 1999 also were affected by the remnants of the Asian crisis. In the first 6 months of 1999, the total export value fell 4.6 percent from a year earlier. However, in the third quarter, monthly exports started to grow compared with the same months in 1998. Export growth rates were 7.5, 17.8, and 20.2 percent in July, August and September 1999, respectively, compared to a year earlier. By the end of September, accumulated total exports for 1999 showed a recovery, with a 2.1-percent growth rate from the same period of 1998. China's export growth in the last 3 months of 1999 will be aided by the government's tax rebate policy, as well as the recovery of the Asian economies. Total exports in 1999 are expected to exceed the 1998 level.

Figure 1

China's GDP and export growth rates

Percent



Source: China, National Bureau of Statistics and China Customs Statistics.

Figure 2

Ratio of China's exports to GDP

Percent



Source: China, National Bureau of Statistics and China Customs Statistics.

In 1998, China's total imports fell 0.4 percent. However, imports jumped 19.3 percent in the first 9 months of 1999. The decline in 1998 was mainly attributable to weak domestic demand, while the rapid growth in 1999 can be partly explained by soft world market prices. Government campaigns against smuggling since late 1998 may have also contributed to the rise in *officially recorded* 1999 imports.

China continued to run a surplus in merchandise trade during the first 9 months of 1999. However, with accelerated growth in imports and sluggish growth in exports, the surplus has shrunk severely. The trade surplus was \$19.4 billion for the first 9 months of 1999, down from \$35.4 billion in the same period of 1998. Clearly, China's overall trade surplus in 1999 will be significantly lower than 1998's \$43.6 billion.

Foreign direct investment (FDI) grew at an average annual rate of over 40 percent in the first 7 years of the 1990s. But FDI growth stopped in 1998, remaining essentially unchanged at \$45.6 billion. Total foreign capital inflows were down 8 percent to \$58.9 billion from their 1997 peak of \$64.4 billion, mainly due to a decline in the value of stock shares sold to foreign investors. Although FDI accounts for a small portion of China's total fixed capital investment, it brings in advanced technology and, even more importantly, access to overseas markets. For example, foreign-funded enterprises accounted for 43 percent of China's total exports in 1998 and for 47 percent in the first 7 months of 1999.

China's total foreign capital inflows, including FDI, are expected to fall significantly in 1999. Through September, foreign capital inflows were 6.8 percent below the same period in 1998. Foreign capital is being diverted to East Asian countries, where currency devaluation has significantly reduced labor costs. Moreover, some foreign companies that already opened businesses in China may re-locate to those countries due to reduced labor costs there. The reduction in foreign capital inflows, especially FDI, will impede China's economic growth.

Despite these developments in China's external economy, the government still hesitates to adjust the exchange rate, which has been almost fixed since 1994. Several factors are contributing to China's reluctance to devalue its exchange rate: weak domestic demand, low interest rates, a still positive balance of trade, and other economic and political considerations, including the stability of Hong Kong's economy. Instead, the government plans to further grant tax exemptions to more exportable commodities and to increase the magnitude of the exemptions. On July 1 China announced that it was raising tax rebates an average 2.95 percent for several export sectors, including garments, textiles, and selected machinery and electrical products. However, widespread tax exemptions will significantly lower government revenues, as most export industries are important contributors to China's value added tax. Moreover, other countries may insist on restricting tax rebates for exports as a condition for their approval of China's pending application to join the World Trade Organization.

Sluggish Domestic Demand and Deflation Are Pressing Problems

Faced with reduced import demand from its Asian neighbors and unwilling to match their currency devaluations, China's government has focused on stimulating domestic demand instead. Nevertheless, China's consumer price index (CPI) had fallen for 24 consecutive months by the end of September 1999, a typical sign of a recession in domestic demand. In 1998, the CPI fell 2.6 percent from the previous year, and it fell an additional 3 percent over the first 9 months of 1999. However, the CPI was slightly improved in September as it fell 2.8 percent, less than the average decline in the first quarter of 1999. The agricultural procurement price index (an indicator of farm gate prices) fell 8 percent in 1998 and at an

even greater rate in the first half of 1999. For example, in April the average price for pork was just over half its level a year earlier. (See livestock article in this report.)

Falling retail prices indicate sluggish consumption. Attempting to stimulate both investment and household consumption, the central bank of China has cut interest rates seven times since May 1996. Short-term interest rates were reduced from 10 percent in May 1996 to less than 3 percent in June 1999. Moreover, a new tax was levied on income from household savings to further discourage private savings.

However, the withdrawal of job benefits for education, health care, housing, and pensions in China's liberalizing economy, coupled with heightened job insecurity caused by government streamlining, is spreading anxiety among China's urban households. When consumers lose confidence in their earning prospects, they increase savings and hold back on spending. National statistical survey data show that urban and rural per capita income increased 5 and 3 percent, respectively, in 1998, while yearend household savings in the country as a whole rose 17.1 percent.

The government also tried to expand consumer credit to encourage consumption. For example, the Investment Bank of China began to promote credit for durable consumer goods, home improvements, and college loans, in addition to previously implemented loans for housing and automobile purchases. However, many studies have shown that households in China are reluctant to finance consumption, both for cultural reasons and because of the practical difficulties of obtaining loans.

Deflation hit corporate profit margins. In 1998, total corporate profits of China's enterprises fell 17 percent while total corporate business losses rose 22 percent. Moreover, weak domestic and export demand led to rising inventories of manufactured goods and agricultural products. Production overcapacity became a common phenomenon in many sectors. Reportedly, more than half of China's industrial enterprises operated at less than 40 percent of capacity in 1998, with many operating part-time.

Seeing massive industrial overcapacity and falling producer prices, the central government has decided to reduce the number of small factories in selected manufacturing sectors over the next 2 to 4 years. These plants often use outdated technology, have high-energy consumption, are severely polluting, and make products of low quality. However, given that the small plants benefit local governments by providing taxes and local employment, the central government will have difficulty reaching its goals.

Expansive Fiscal Policy Aims To Boost Economic Growth

In another attempt to counter the sluggish domestic economy, China's government has adopted an expansive

fiscal policy with an unprecedented amount of state investment in infrastructure and public works. An additional RMB 100 billion (US\$ 12 billion) of bonds were issued in late 1998 to finance an infrastructure spending program, and 25 billion more were put into circulation in early 1999. Moreover, the government spent more than RMB 50 billion in 1999 on a mix of unemployment benefits, raising salaries for civil servants and meeting pension obligations. The government's fiscal deficit rose to RMB 96 billion in 1998, and is forecast to increase to a record RMB 150 billion in 1999.

The government fiscal policy did boost investment, which rose 14 percent in 1998 and another 8.1 percent in the first 9 months of 1999. The additional investment stimulated some industrial growth, mainly in the capital goods industries. In the first 9 months of 1999, total industrial value added was 9.3 percent above the same period a year earlier, while value added for heavy industry was 9.9 percent higher. Real GDP was 7.4 percent higher in the first 9 months of 1999, compared with January-September 1998. However, GDP growth slowed, from 8.3 percent in first-quarter 1999 and 7.1 percent in the second quarter, to 7 percent for the third quarter. With continued deceleration forecast for the last quarter of the year, GDP growth in 1999 is expected to barely attain the government's 7-percent target.

Some of China's domestic economists have already warned the government that infrastructure investments usually involve large short-term expenditures followed by a long wait for economic returns. Moreover, the very massive scale of the government infrastructure investment program imposes a considerable risk of inefficiency and waste.

Prospects

China's economy has reached a difficult stage. With a fall in foreign investment, growth in China's exports would have slowed even without the Asian crisis. Exports will increasingly depend on China's own industrial competitiveness instead of export processing for foreign firms. Domestic demand and domestic industrial structure will play a more important role in China's future development and growth. China faces these challenges while its domestic economy is still heavily dependent on a state-owned enterprise system for which reform is still a difficult and far from finished task.

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China Is Awash in Grain

Despite summer drought, China's 1999/2000 grain harvest is forecast to be 1 million tons above the 394 million recorded in 1998. The "governor's grain bag responsibility system" has provided the dominant direction in China's grain policy over the past 4 years—raising grain production, enlarging stocks, and increasing self-sufficiency—leading to fewer imports and attempts to expand grain exports. [Frederick W. Crook, (703) 759-7197; fwcrook@erols.com]

Grain Situation in 1999 Controlled by "Grain Bag" Policies

USDA estimates that China's output of wheat, rice, and coarse grains for 1999/2000 was 395.1 million tons, slightly above the previous year's 393.9 million. As the world's largest grain producer, China used 13 percent of global farmland to produce 21 percent of world grain output in 1998. Since late 1994, policies identified in China as the "governor's grain bag responsibility system" have encouraged local administrators and farmers to boost grain output, increased the quantity of grain in storage, and reduced dependence on imports. This policy succeeded, perhaps too well, because in every year from 1995 onward grain output exceeded demand, pushing down market prices. Although farmers would normally reduce plantings under such conditions, the area sown to grain crops increased again in 1999 because of the governor's grain bag policy (table 2).

As grain surpluses began to accumulate, government leaders became increasingly concerned about grain handling and storage problems. In 1994, the World Bank and Chinese officials initiated a "grain distribution and marketing project" funded by more than US\$1 billion in loans. The project was designed to improve China's capacity to manage internal grain shipments, but not specifically to expand grain storage capacity. With the continued buildup of surplus grain, much of which had to be stored on the open ground, government leaders in Beijing decided in 1997 to adopt various plans to expand grain storage capacity, including converting idle factories into grain bins. These projects had high costs and proved to be ineffective for moving surplus grains to deficit areas. In 1998, the State Development Planning Commission announced an 18-billion RMB (US\$2.2 billion) project to build 388 new grain depots with a storage capacity of over 25 million tons. By mid-1999 over 300 depots were under construction, with 13 million tons of storage space scheduled for completion in time to receive the newly harvested wheat crop.

The size of China's grain stocks are treated as state secrets. The authorities in Beijing have limited themselves to

announcing that stocks are at record levels without giving specific numbers. Likewise, on-farm-stocks probably are record high, since farmers have encountered difficulties selling grain to government-owned depots, which have bulging bins and little money to purchase grain at the government-dictated support price. To make way for the current crops, some grain depots have begun to sell off grain reserves, including stocks of 3-year-old imported wheat. The least desirable portions of China's reserves are composed of low quality grains, such as spring wheat and high-moisture corn from the northern tier of provinces, winter wheat from provinces south of the Yangtze River, and early indica rice crops from southern provinces. Authorities already have announced their intention to bar these products from entering central government depots in 2000, as the government will then cease supporting the prices of these crops.

The costs of China's grain reserve policy have increased substantially. For example in 1999 the central government financial institutions reserved 50 billion RMB (US\$ 6 billion) just to cover grain storage fees and interest charges. Some 200 billion RMB (US\$ 24 billion) is already tied up in bank debts for past grain purchases and now the government must seek even more funds to purchase 1999 grain crops.

For 1999/2000 China again will be basically self-sufficient in grain. Its corn exports will be limited because the domestic price for corn is well above the international price. China is expected to export 10.9 million tons of rice and coarse grains in 1999/2000. Domestic demand for high-quality wheat and rice will drive imports to 1.1 million tons (table 3).

Second Largest Wheat Crop Predicted for 1999

The 29.8 million hectares sown to wheat for the 1999 harvest are about the same as a year earlier. Wheat regions had very dry weather from September 1998 through the end of the year, but farmers intensified cultivation practices and irrigated the crop where possible, so that yields are about the same as in 1998. Output is expected to be 115 million tons (see table 3).

Table 2--Governor's grain bag policy objectives and accomplishments, 1995-98 1/

Policy objective	Results in 1995	Results in 1996	Results in 1997	Results in 1998
1. Increase grain area	110.1 mil. ha; up from 109.5 in 1994	112.5 mil. ha	112.9 mil. ha	113.8 mil. ha
2. Increase supply of chemical fertilizer	Up 8.1%	Up 6.6%	Up 4%	Up 2.6%
3. Raise yields	Rose to 4.24 mt/ha	Rose to 4.49 mt/ha	Fell to 4.38 mt/ha, due to droughts	Recovered to 4.50 mt/ha
4. Increase grain production	467 mmt, up 4.9% from previous year	505 mmt, up 8.1%	494 mmt, down 2.1%	512 mmt, up 3.7%
5. Maintain ample grain stocks				
Government-held stocks	Rose 25 mmt	Rose 52 mmt	Record high	Record, >250 mmt
On-farm stocks, Dec. vs Jan.	Year-end stocks up 21%	Year-end stocks up 33%	Year-end stocks up 20%	Increase, size unknown
6. Enforce centrally planned inter-province grain transfers 2/	Partial success	Partial success	Partial success	Partial success
7. Ensure grain supplies to cities	Yes	Yes	Yes	Yes
8. Stabilize grain prices, both within and across years 3/	Low--1.68 yuan/kg	Low--2.40 yuan/kg	Low--2.60 yuan/kg	Low--2.60 yuan/kg
Trend	High--2.60 yuan/kg	High--2.90 yuan/kg	High--2.90 yuan/kg	High--2.90 yuan/kg
Coefficient of variation	53% rise	12% rise	0% change	23% decrease
9. Raise government agencies' share of commercial sales 4/	8% (was 17% in 1994)	3%	7%	na 5/
10. Retain government's control over grain imports and exports	Probably	Probably	Probably	Probably
11. Increase grain self-sufficiency	Yes	Yes	Yes	Yes
	96.7% (was 96.3% in 1994)	99%	100%	100%

1/ Grain statistics are based on China's definition, where total grain includes soybeans and the grain-equivalent of tubers. See Appendix table 1.

2/ Some provinces erected formal and informal barriers to grain transfers, as reflected in "partial success" ratings.

3/ Three indicators of price stability are shown, all based on monthly urban retail prices for indica milled rice in the city of Changsha: the lowest and the highest price over the course of the year, the percent price change from January to December, and the monthly prices' coefficient of variation.

4/ The protection price mechanism came into play in 1996, 1997, and probably 1998 for various grain crops, requiring the government to make additional grain purchases. Also, the 1998 grain reform places more food grains under government control, at least in principle.

5/ Missing data for part of the year prevent calculation of a coefficient of variation.

Sources: Economic Research Service; *China Statistical Yearbook*, *China Agricultural Yearbook*, *China Price Monthly*.

In 1999, the fixed quota price was lowered to about the level of the 1998 support price.¹ In 1998, for example, the wheat fixed quota procurement price in Shandong province was about US\$176 per ton while the support price was US\$154. But for 1999 both the fixed quota and the support price were set at US\$154 (see figure 3), about 30 percent higher than the U.S. hard red winter wheat f.o.b. prices, which ranged from US\$110 to US\$120 per ton. Also, China's Grain

Bureaus now have the authority to pay different prices for different qualities of wheat.

Farmers in northern China, where wheat products predominate in the traditional diet, tend to retain a large portion of their wheat harvest for on-farm consumption. In other parts of the country, local and central government grain depots have ended up holding low quality spring and winter wheat stocks. Authorities report that 7.5 million tons of inferior wheat now account for nearly one-third of China's 26 million tons of wheat stocks. As the quality of this wheat further deteriorates through time, the depots are likely to sell it as feed wheat, even though it was acquired for food grain security. In addition, some provinces with large wheat crops,

¹ Fixed quota and support prices were set by the government at national and provincial levels for procuring wheat, rice and corn. Farmers are required to deliver fixed quantities of these commodities to government owned grain stations at fixed quota prices before they can sell unlimited amount of grains at support prices to the government. In the past, fixed quota prices were always higher than the support prices in all commodities.

Table 3—China's grain production, trade, and ending stocks, 1997/98-1999/00

Item	1997/98	1998/99	1999/00
<i>Million tons</i>			
Total grain as reported by China (Jan./Dec.) 1/			
Production	494.2	512.3	Not available
Total grain as reported by USDA (Jan./Dec.) 2/			
Production	378.5	393.9	395.1
Imports	3.7	3.6	4.2
Exports	11.1	6.5	11.4
Ending stocks	87.3	94.6	93.1
Wheat (July/June)			
Production	123.4	109.7	115.0
Imports	1.9	0.8	0.7
Exports	1.2	0.4	0.5
Ending stocks	33.5	27.9	26.1
Rice (Jan./Dec.)			
Production (paddy)	200.7	198.7	201.4
Production (milled)	140.5	139.1	141.0
Imports (milled)	0.3	0.2	0.4
Exports (milled)	3.7	2.7	2.9
Ending stocks (milled)	26.7	26.5	27.0
Corn (Oct./Sep.)			
Production	104.3	133.0	128.0
Imports	0.3	0.3	0.3
Exports	6.2	3.3	8.0
Ending stocks	26.0	38.6	38.9

1/ The Chinese definition of total grain includes wheat, rice (on a paddy basis), coarse grains, soybeans, tubers (with their grain equivalent calculated as 1/5 of raw weight), pulses, and other grains.

2/ The USDA definition of total grain includes only wheat, rice (on a milled basis), and coarse grains.

Sources: *China Statistical Yearbook*; USDA, *World Agricultural Supply and Demand Estimates*.

such as Shandong, regularly allocate about 20 percent of their wheat harvest for feed.

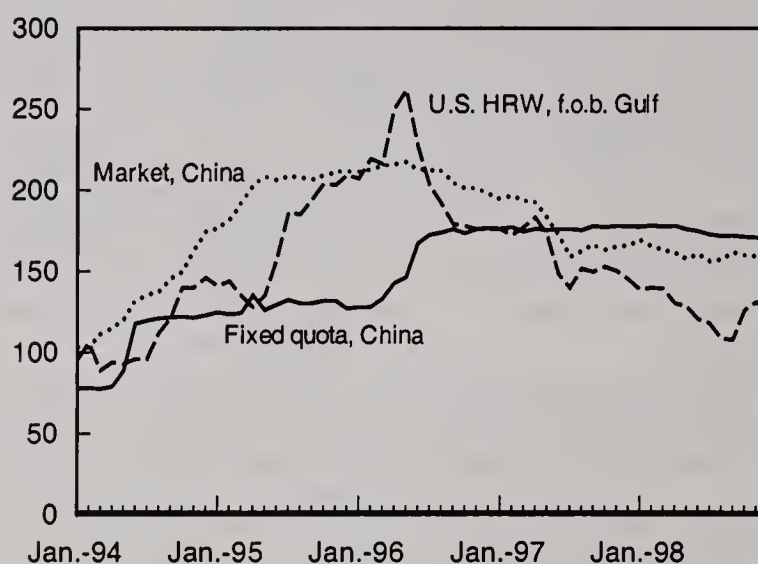
Grain depots report that low quality wheat has very little market value and that they have no intention to purchase any low quality spring wheat in 2000. The government also announced that support prices and fixed quota prices will not be set for spring wheat produced in Inner Mongolia, northern Hebei, Heilongjiang, Jilin, and Liaoning provinces, nor for low quality winter wheat produced in some provinces south of the Yangtze River.

The grain bag policy has had a dramatic impact on China's wheat imports. Wheat imports were larger in 1995 and 1996 than in 1993 and 1994, as wheat stocks were built up to meet the food security requirements of the grain bag policy. Once the food grain security stockpile objectives had been reached, and with rising domestic production, wheat imports fell drastically (figure 4).

Figure 3

Wheat prices

US\$/ton

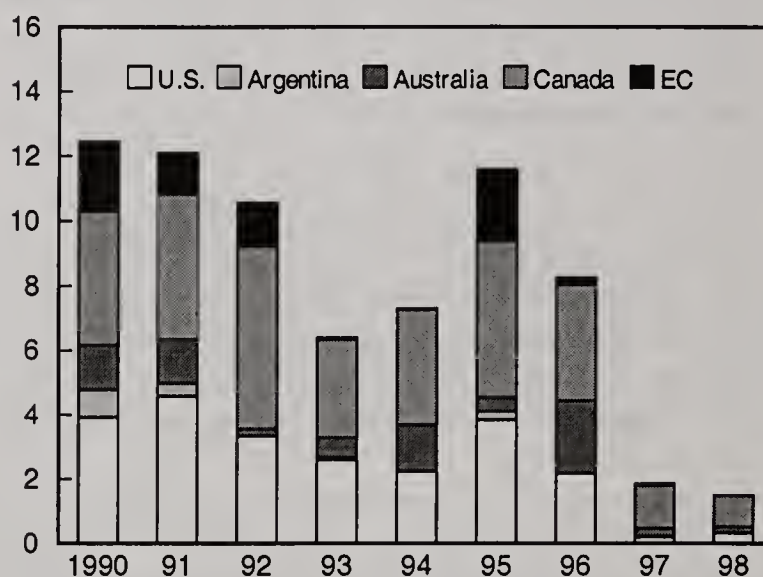


Source: China, Ministry of Agriculture and ERS/USDA.

Figure 4

China's wheat imports, by source

Mil. tons



Source: China Customs Statistics.

Second-Largest Rice Crop Forecast for 1999

Paddy rice output for 1999 is forecast at 201.4 million tons, slightly above 1998's 198.7 million. Although the early and double-crop late rice areas dropped slightly in 1999, increased area sown to intermediate and single-crop late rice caused total rice area to expand. Research institutes are working to improve the quality of older varieties now planted on about two-thirds of the early rice area.

Market prices for Indica rice peaked in mid-1995. They decreased steadily in 1996 and fell below the fixed quota price in mid-1997. Market prices remained below the fixed

quota price until mid-1998 when the fixed quota price was reduced to the same level as the market price (figure 5). Given falling prices, farmers normally would sow less rice. But several conditions pushed farmers to sustain output. As they did for other grains, local officials pushed farmers to raise rice in accordance with the objectives of the grain bag policy. Natural conditions such as soil, climate, tradition, and still poorer profit prospects for alternative crops also may have led farmers to continue growing rice. Provinces have reduced the fixed quota price for the 1999 crop to the level of the 1998 support price. At the same time, provincial Grain Bureaus are permitting their grain depots to offer prices that vary with quality.

Early indica rice has the advantages of having high yields (5.6 tons per hectare) and kernels that store well in grain bins, compared with late crop indica rice, wheat, or corn. Given the policy environment in the 1990s, farmers opted to grow and sell this rice to fulfill their rice quota obligations at local grain depots. The difficulty for Grain Bureaus was that while the early rice stored well, consumers generally did not like to eat it. Stocks accumulated, Grain Bureaus ended up keeping the grain for several years, ultimately selling it at low prices to food processors and feed mills. The government has vowed to end this expensive practice. Grain depots are offering lower prices for early rice in 1999 and farmers have already been informed that in 2000 there will be no fixed quota or support prices for low quality early indica rice.

Higher prices for japonica rice have encouraged area expansion in northern China, but the expansion is limited by a general shortage of water. Some parts of Heilongjiang province, however, have abundant water resources and the area sown to rice is expanding there. The port of Dalian, Liaoning province, which is in China's northeast, has

become an important source of japonica rice exports to buyers in Japan and Korea.

With large rice crops in 1994-1998, static or even declining per capita rice consumption, and the resultant buildup of large stocks, China has rice available for export. In calendar 1998, China's rice exports reached a record 3.7 million tons. China's domestic rice prices are considerably below the Thai export price, though China's rice is not up to Thai quality. Most of China's exports went to food-grain short Middle Eastern and African countries. Exports for the 1999/2000 crop year are forecast at 2.9 million tons.

China imports high quality indica rice from Thailand, which is primarily consumed by high-income urban consumers. Imports totaled 170,000 tons (milled basis) in 1998/99 and are forecast at 400,000 tons in 1999/2000.

Corn Production Down Due to Unfavorable Weather

After the record corn crop of 133 million tons in 1998/99, China's 1999/2000 corn production is forecast at 128 million tons, down 4 percent or 5 million tons from last year. The area planted rose 560,000 hectares from 1998 to 25.8 million hectares. Yields are forecast to decrease to 4.78 tons per hectare due to unfavorable summer weather in several provinces.

Farmers in China's northeast (e.g., Jilin province) have few alternatives to growing corn. Where soybeans are an agro-nomic alternative, their low domestic price makes them less profitable than corn. Officials encouraged farmers in feed-grain short, predominantly rice-producing areas in south China to boost the area sown to corn. For example, farmers in Hunan province planned to sow 400,000 hectares to corn, more than double the 171,000 hectares planted in 1997. However, the total net gains in southern corn areas were minimal.

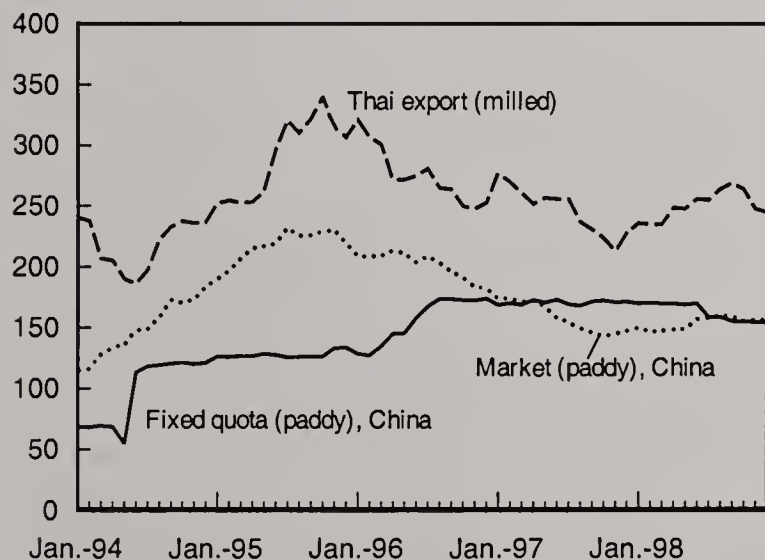
China's fixed quota and market prices for corn in 1998 remained just under US\$150 per ton, well above the U.S. No. 3 f.o.b. Gulf price of just over US\$100 per ton (figure 6). Market prices in China in the first 6 months of 1999 fell steadily, reaching US\$124 per ton in July at a time when the U.S. corn export price had fallen below \$80 per ton.

In north and northeast China, corn constitutes a large portion of total grain stocks. Although the Grain Bureau specifies a moisture standard for corn of 15 percent, the moisture in Northeast corn is sometimes greater than 30 percent, making it difficult to transport, store, and mill. In the past few years, USDA officials traveling in the northeast have observed a growing number of newly constructed corn dryers at grain stations, grain depots, and rail heads. Much of China's northeast corn can be stored in temporary wicker-walled, thatched-roof bins because autumn and winter weather is cold and dry. China is building one of the world's largest grain storage and handling facilities in Xizui in the

Figure 5

Rice prices

US\$/ton

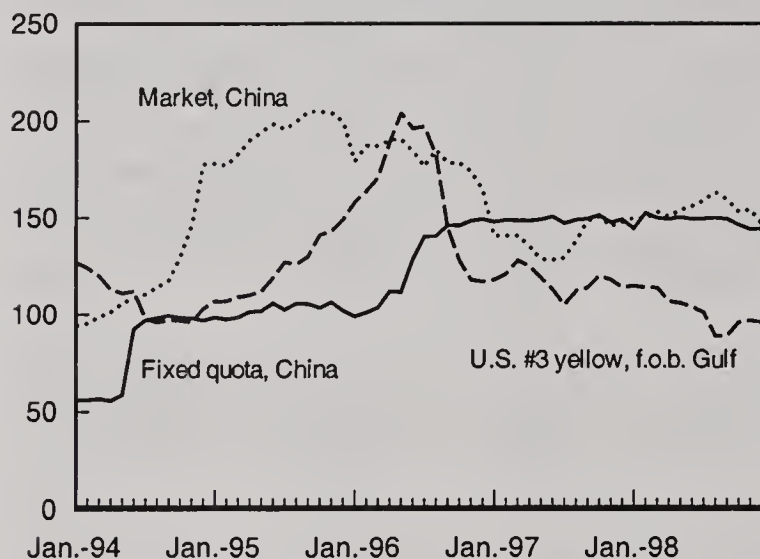


Source: China, Ministry of Agriculture and ERS/USDA.

Figure 6

Corn prices

US\$/ton



Source: China, Ministry of Agriculture and ERS/USDA.

port of Dalian, to handle both corn and rice exports, as well as wheat imports.

Corn exports for 1998/99 are forecast to reach 3.3 million tons, down from 6.2 million tons in 1997/98. Some of the

corn exported in 1997/98 and 1998/99 likely came out of stocks. This corn might have been purchased back in 1995 and 1996, when fixed quota prices were below both China's domestic market prices and international prices. In 1999/2000, China likely will export more corn, about 8 million tons, because domestic prices are expected to be substantially lower in the second half of 1999.

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China Switches from Soymeal to Soybean Imports

China's soybean area continues to decline as grain policies encourage producers to plant corn, wheat, and rice instead. In 1998, China's preferential trade treatments for importing soybean meals caused a glut of protein meal, idled crushing facilities, and led to extensive smuggling of vegetable oils. Effective July 1, 1999, China re-imposed the 13-percent value added tax for soymeal imports to discourage meal imports and encourage more imports of soybeans.

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China's 1999/2000 soybean production is expected to fall to 14 million metric tons, 7 percent below 1998/99. The lower production stems from a decline in planted area. The National Bureau of Statistics (NBS) planting survey estimated that 7.6 million hectares were sown to soybeans in 1999, down 10.6 percent from 1998.

In recent years, Heilongjiang, in China's northeast bordering Russia, has been the leading province in terms of soybean production, accounting for 30 percent of China's soybean area and 40 percent of its production. An extended cold winter in Heilongjiang reduced planting of spring wheat in spring 1999, and local officials believe that farmers may have compensated by planting more soybeans than they reported in the NBS Survey.

Most fluctuations of China's soybean area occur in Heilongjiang. In the Northern China Plain of Hebei, Henan, and Shandong, the area planted to soybeans has remained stable because of traditional crop rotation practices.

Although the government intervenes in soybean production, trade, and oilseed crushing, China's support for the oilseed sector is much less than for major food and feed grains (table 4). The ratio of the government's fixed-quota procurement price for soybeans and its price for corn fell from a peak of 2.42 in 1993/94 to 1.83 in 1998/99. Since 1996,

when soybean support prices were terminated in most provinces except Heilongjiang, many producers have switched to alternative crops, especially more profitable cereal grains.

Domestic crushing margins have increased due to low world soybean prices and a recently imposed 13-percent value added tax (VAT) on soymeal imports. As a result, China's soybean imports are projected to jump from 3.9 million tons in 1998/99 to 5.0 million tons in 1999/2000, while soymeal imports are projected slip from 1.4 million tons in 1998 to 0.5 million tons in 1999 (table 5). Soyoil imports are forecast to decrease from 1 million tons in 1998 to 0.7 million in 1999, mainly because of high inventory and offsetting imports of rapeseed and palm oils.

Imports Offset Declining Production

China is the world's fourth largest soybean producer, behind the United States, Brazil, and Argentina, with an estimated output of 14 million metric tons in 1999/2000. Since the record output of 16 million tons in 1994, China's production has fallen gradually mainly because of declining government support (figure 7).

With annual use (including crush) estimated at 18.7 million tons and production at 14 million tons, China's soybean imports are expected to increase to a new high of 5 million

Table 4--Relative support prices for soybeans and corn, China and the United States, 1991/92-1998/99

Item	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99
China's fixed quota prices								
	Yuan/ton							
Soybeans	902	971	1,384	1,837	1,840	2,263	2,336	2,204
Corn	397	441	572	845	938	1,230	1,236	1,203
Price ratio (soy/corn)	2.27	2.20	2.42	2.17	1.96	1.84	1.89	1.83
U.S. loan rates								
	\$/bushel							
Soybeans	5.02	5.02	5.02	4.92	4.92	4.97	5.26	5.26
Corn	1.62	1.72	1.72	1.89	1.89	1.89	1.89	1.89
Price ratio (soy/corn)	3.10	2.92	2.92	2.60	2.60	2.63	2.78	2.78

Source: China, Ministry of Agriculture, Information Center; and USDA, *Oil Crops Yearbook* and *Feed Yearbook*.

Table 5--China's soybean, soymeal, and soyoil production and trade, 1997/98-1999/00

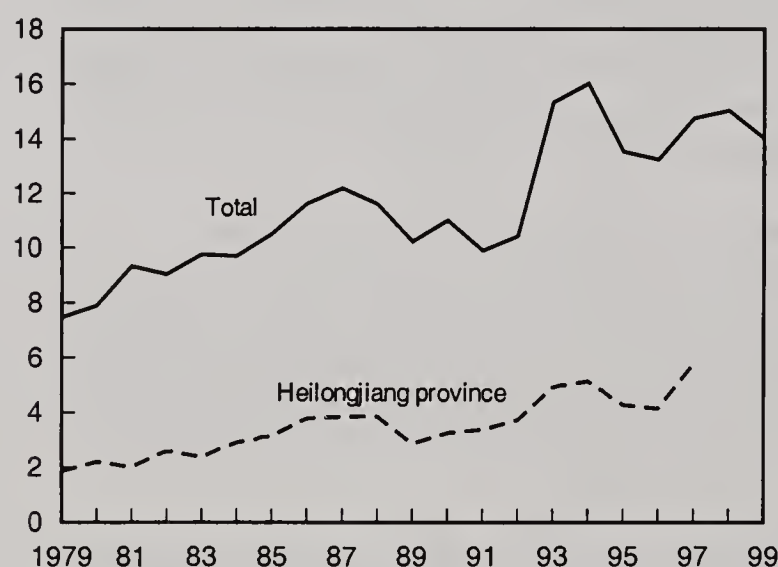
Item	1997/98	1998/99	1999/00
<i>Million tons</i>			
Soybeans			
Production	14.73	15.00	14.00
Imports	2.94	3.85	5.00
Exports	0.17	0.18	0.10
Soymeal			
Production	8.58	9.45	9.70
Imports	4.20	1.40	0.50
Exports	0.02	0.01	0.01
Soyoil			
Production	1.78	1.97	2.00
Imports	1.65	0.95	0.73
Exports	0.08	0.08	0.08

Source: USDA, *World Agricultural Supply and Demand Estimates*.

Figure 7

China's soybean production peaked in 1994

Mil. tons



1998 and 1999 USDA forecast, October 1999.

Source: China, National Bureau of Statistics.

tons in 1999/2000 to make up the difference. Although China always has emphasized food security, only three provinces—Heilongjiang, Jilin, and Inner Mongolia—still held public soybean inventories at the end of 1998. [Hsu and Ash, 1999]

Smugglers Bring in Edible Oils

As household incomes in China have grown, edible oil consumption has increased, and refined salad oil is becoming increasingly popular [Colby, 1998]. Many consumers have switched from animal fat to vegetable oils for frying. Urban residents are shifting to refined salad oil from less refined (Grade 2) soybean oil. Rural residents also are moving gradually towards urban consumption patterns with less animal fat and more refined vegetable oils. Increasing population

and high rates of economic growth have sustained a rapid increase in China's demand for vegetable oils. However, China is unable to achieve self-sufficiency in vegetable oil production in large part because higher government support for cereal grains has induced producers to plant grains rather than oilseeds.

At present, China's vegetable oil imports are restricted by government licensing and quota controls, an unfavorable tariff rate of 20 percent, and a value added tax (VAT) of 13 percent (table 6). After highly publicized accounts of unreported imports (smuggled or under-invoiced) of edible oils, China's government started a major campaign against smuggling in the summer of 1998, and placed edible vegetable oils at the top of the list. Some customs officials were prosecuted for bribes or corruption, and military units were sternly warned to stop business operations.

In 1997/98, prior to the clampdown, as much as 1 to 2 million metric tons, or about 10 to 18 percent of total edible oil consumption, were reportedly smuggled into China [Hsu and Crook, 1998]. Following the stepped-up enforcement, soyoil prices in China rose at the same time as cash market and futures prices in the United States were falling. Chinese soyoil prices peaked at US\$1,021 (RMB 8,475) per ton, or US\$0.46 per pound, in December 1998, up 14 percent from a year earlier (table 7).² Although many economic factors contributed to soyoil market fluctuations, China's crack-down on smuggling played the central role in domestic markets. Because China had accounted for about a quarter of world soyoil imports (excluding smuggling) since 1994, the anti-smuggling campaign probably pushed down world market prices by curtailing demand in international market.

There are only six licensed importers for vegetable oils in China. They are:

- * China National Cereals, Oils and Foodstuffs Import and Export Corporation (COFCO)
- * China National Native Produce and Animal By-Products Import and Export Corporation
- * China Resource National Corporation
- * China Nam Kwong Import and Export Corporation
- * China Liang Feng Grain Import and Export Corporation
- * China Grains and Oils Group Corporation

All of these importers are state-owned trading companies with various degrees of government holdings and management. Most oil crushing and refining facilities in China are state-owned as well. Although the number of joint-venture and private crushers and refiners is increasing, they do not have complete control of their sources of supply, nor are they allowed to freely import crude oils for refining.

² This compares with the average wholesale price for crude soybean oil of \$0.24 per pound in Decatur, IL in December 1998.

**Table 6--Favorable treatment of soymeal imports
was eliminated in 1999**

Product	Tariff-rate quota 1/		Value added tax		Import licensing
	Quota	Tariff	1998	1999	
	----- <i>Percent</i> -----				
Soybeans	Yes	3	13	13	None
Soymeal	None	5	0	13	None
Soyoil	Yes	13	13	13	Yes

1/ China's tariff-rate quotas (TRQs) are in name only. Quota levels are not announced to the public. Because government officials have never permitted imports exceeding the quotas, over-quota tariff duties were never levied.

Source: China Customs Administration.

Table 7--Soybean and soy product prices, 1996-99

Year	Soybeans	Soymeal	Soyoil
	Yuan/ton 1/		
1996	3,096	2,730	7,414
1997	3,144	2,872	7,355
1998	2,582	2,079	7,988
1999 (January through March)	2,226	2,226	2,226
	Percent change		
Comparison of Q1 98 to Q1 99	-22	-40	9

1/ For yuan-to-dollar exchange rates, see Appendix table 12.

Source: China, State Administration of Grain Reserves,
National Grain and Oil Information Center.

Since China's government started its anti-smuggling campaign in the summer of 1998, official imports of soyoil showed a remarkable recovery while official exports declined (figure 8). China's soyoil exports were relatively small because only a small portion of the crushing plants (mostly foreign owned) could import raw beans or crude oils, then crush, refine, and re-export to overseas destinations to enjoy VAT-free benefits. The decline in official exports was caused by attractive domestic prices, which reflected the fall in smuggling. Before the anti-smuggling campaign, some declared exports of oils were smuggled back into the country as a means to avoid paying the VAT on sales of domestic goods. Also, China has been slow to issue import quotas for edible oils, to protect its own crushing industry. As China continues its campaign against smuggling, comparative statistics support the view that "unofficial" imports were significant in the 1998 marketing year (October-September). Based on Custom Service monthly reports, China's soybean oil imports between January and July 1999 have increased 32 percent compared with the same period a year earlier.

In the 1997/98 marketing year, total soyoil exports to China (including Hong Kong) reported by the United States, Brazil,

Figure 8

China's official monthly imports and exports of soyoil in 1998 and early 1999

1,000 tons



Source: China Customs Statistics.

Argentina, and the European Union were about 1.65 million tons higher than China's official, Customs-reported imports from all origins. This suggests that a significant portion of the edible oil found its way into China surreptitiously.

Soymeal Imports Slow as Demand for Livestock Products Slumps

Prior to 1999, China provided a favorable trade environment for soymeal imports to foster the feed and animal products sectors. No VAT and only a 5-percent tariff was levied on imports (table 6). These policies encouraged a flood of soymeal imports, rising from a negligible 1,000 tons in 1995 to 4.2 million tons in 1997/98. As a result, China's processors were discouraged from importing beans for crushing. When the government initiated a major campaign against smuggling edible oils in the summer of 1998, China's oilseed crushers were having a difficult time. The world prices for both soymeal and soyoil were so cheap that the domestic crushing margin had become extremely low and sometimes even negative.

Falling demand for meat in 1998 and early 1999 translated into lower demand for protein meals which, in turn, caused China's soymeal prices to decrease dramatically (see livestock article by Tuan et. al.). The price of soymeal was RMB 1,559 per ton (US\$189/ton) in the first quarter of 1999, 40 percent lower than a year earlier, while cash market prices in the United States dropped only 29 percent during the same period.

In its negotiations for membership in the World Trade Organization, China claimed it would cease imposing a quota for soybean imports and would not subsidize exports of soybeans and soy products. This is tantamount to no change from the status quo. China has been a soybean-

deficit country and its exports of soybeans and soy products are negligible. China's imports of soybeans, soymeal, and soyoil would not change much under this proposal because China has been already more open to trade in soybeans, at least compared with grains. China would prefer to import raw materials (soybeans), use its large, but usually inefficient, crushing facilities, and retain the crushing margin. However, the government realizes that soymeal and soyoil imports will continue to flow as long as world prices remain attractive and domestic consumption stays robust.

Changes in Rapeseed and Peanut Production Are Mutually Offsetting

China does not intervene in the domestic production of oilseed crops other than soybeans, such as rapeseeds, peanuts, and sunflower seeds. Total oilseed output excluding soybeans rose from 21.6 million tons in 1997 to 23.1 million in 1998. Peanut production rose 24 percent to 11.9 million tons.

Rapeseed production decreased from 9.6 to 8.3 million tons in 1998 due to severe winter weather conditions, then recovered to 9.7 million tons in 1999. Most rapeseed is grown as a winter crop, with spring rapeseed accounting for only 10 percent of the total. China's rapeseed imports leaped from 55,000 tons in 1997 to 2.1 million tons in 1998. Assuming a 38-percent oil yield, the imported rapeseed in 1998 was equivalent to 0.8 million tons of oil. Crushers in southern China favor rapeseed over soybeans due to its high oil content. Because of excellent results from crushing imported seed during the past year, crushers welcome and would like to get more rapeseed imports.

Since the mid-1980s, rapeseed production has expanded rapidly in Hubei, the center of China's rapeseed producing region. Winter wheat and barley are the principal crops that compete with winter rapeseed in the central Yangtze River area including Hubei. There is considerable potential for expanding rapeseed production in Hubei's neighboring provinces, such as Anhui and Hunan. Hubei's rapeseed area

expanded more than 10 percent in 1999/2000. However, dryness during the winter growing season is expected to keep production increases below 10 percent. Hubei's total oilseed production (excluding soybeans) was 2.16 million metric tons in 1998, of which rapeseed accounted for 1.65 mmt. Rapeseed yields have greatly improved, to 1,778 kg/ha in 1998 from 1,200 kg/ha 10 years ago. The share of "double-low" rapeseed (canola type variety) has increased, accounting for 550,000 hectares of the total rapeseed area of 900,000 hectares in Hubei. The government has been receptive to using biotechnology-enhanced rapeseed that would further enhance yields and reduce the need for oilseed and edible oil imports.

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Demand for Livestock Products Stalls

Rapid increases in livestock product consumption have slowed over the last few years as income growth declined. Meat prices have plummeted since early 1998, particularly for pork. China's livestock markets have also suffered from disease problems. China's livestock product trade has developed very slowly. Export markets are very localized, with most shipments going to China's closest neighbors—Hong Kong, Japan, and Russia. [Francis Tuan (202) 694-5238, Hunter Colby, (202) 694-5215, and Qingbo Cao, Information Center, China Ministry of Agriculture; ftuan@ers.usda.gov, whcolby@ers.usda.gov, qcao@agri.gov.cn].

Since the beginning of rural reform in 1978, China's livestock inventory and meat production grew tremendously, spurred by rising population, income growth, and structural and market reforms. As incomes rose in the early 1990s, particularly in urban areas, demand shifted away from consuming greater quantities of meat toward consuming higher quality meats. In 1997 and 1998, declining income growth, changes in consumer preferences, and increasingly efficient of livestock production, marketing, and processing, led to an excessive supply of animal products and falling prices. These problems have been most evident for pork (which accounts for 85 percent of China's red meat output); but beef, mutton, chicken, and egg prices also have declined. Prices have remained low in the first half of 1999, but are expected to recover slightly during the remainder of the year. In the last few years, China's livestock markets have also suffered from problems such as foot and mouth disease and the avian flu, further contributing to their instability.

Meat Supply Outpaces Demand

China's meat output was abundant in early 1998. Consequently, livestock product prices, especially for pork and chicken meat, fell sharply (table 8). Nevertheless, meat output grew by 6.5 percent in 1998 because farmers were slow to respond to market price signals with timely supply adjustments. According

to China's Ministry of Agriculture, red meat output (pork, beef, and mutton) reached 43.6 million tons in 1998. Survey statistics from the Ministry of Agriculture for January-March 1999 indicate that China's total meat output was 6 percent above the same period in 1998. Pork output was up 7 percent, eggs up only 2 percent, and milk output was only slightly greater than in the previous year.

On the demand side, the once rapid increases in livestock product consumption slowed as income growth declined over the last few years. The slowdown in urban income growth was largely due to higher rates of unemployment due to the government's downsizing policy. Since the beginning of 1999, declining procurement prices for many agricultural commodities have also squeezed rural incomes. The 1998 household income and expenditure surveys conducted by the National Bureau of Statistics indicate urban per capita expenditures for fresh and processed meat products decreased 6.2 percent from a year earlier while rural per capita expenditures on all food items dropped 4.6 percent. Although the central government raised salaries for about 84 million urban employees starting on July 1, 1999, overall demand for livestock products is not expected to recover significantly through the rest of the year, particularly demand for pork and chicken eggs—the two most popular

Table 8--Annual changes in China's meat, egg, and live hog prices, 1995-99

Year	Urban retail prices					Live animal prices	
	Pork	Beef	Mutton	Chicken	Eggs	Hogs	Feeder pigs
Percent change							
1995	18.92	35.41	23.39	17.81	11.44	16.43	na
1996	5.68	-2.26	-3.47	12.24	15.58	-0.09	-9.88
1997	12.10	-7.84	-4.65	-8.20	-23.02	12.19	53.90
1998	-11.45	-3.13	-0.72	-11.68	1.71	-18.52	-29.02
1999 1/	-19.01	-2.31	1.26	-1.48	-5.35	-21.09	-48.42

na = not available

1/ Price average, January - August 1999.

Source: China, Ministry of Agriculture, Information Center.

animal products in urban diets. Prices for mutton are expected to rise slightly because consumers are looking for diverse meat products, especially in major urban areas and in certain minority regions (Xinjiang and Inner Mongolia, for example.).

Pork Prices Plummet in 1999

Hogs and pork: Pork prices fell dramatically in the first part of 1999, continuing and even accelerating the downward movement begun in 1998 (figure 9). Over the 20-month period ending in August 1999, prices for live hogs declined 27 percent. Feeder pig prices fell 53 percent over the same period, suggesting that farmers were not expecting a quick recovery in meat prices and were choosing not to replenish their stock as they slaughtered fattened hogs. Retail urban pork prices also declined sharply, falling 23 percent over the 20-month period. Retail urban pork prices have recovered to some extent since June 1999, although it is too early to tell whether the recent increase in demand reflects only a seasonal trend.

Prices declined more for pork than any other meat, primarily because pork output increased rapidly in 1998 and 1999. At the same time, consumption declined as the economy began to slow in 1998, and falling incomes were accompanied by increasing fear of unemployment. In particular, the push to streamline the central government bureaucracy and reduce overstaffing in state-owned enterprises prompted urban households to cut back on expenses.

Prices for lean pork fell less than pork prices overall—13 percent over the 20 months ending in August 1999—due to the shift in consumer preferences towards leaner pork. However, most of China's production is

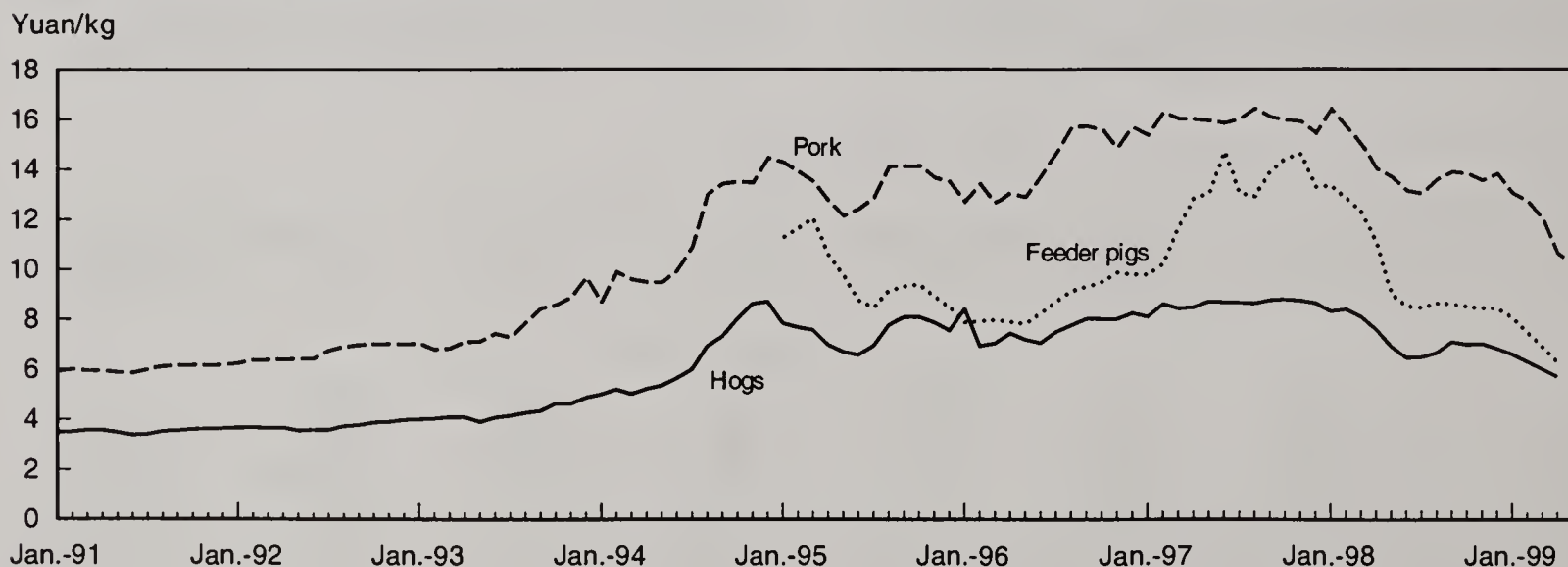
still relatively low quality meat produced by individual backyard farm operations. (See Fang et. al. article in this report concerning pork production.)

Another factor in the decline in pork prices, and perhaps the reason they have fallen more than the prices of other meats, is the government's new policy restricting hog slaughter to government selected and certified operations. Individual farmers (who still produce the majority of China's total pork output) must take their fattened hogs to their assigned slaughterhouse (usually one per county). The monopsony power of the slaughterhouse has forced farmers to pay exorbitant "veterinarian inspection" fees at the time of slaughter, while the slaughter tax set by the government was reportedly widely ignored. Low retail demand for pork has prompted slaughterhouses to offer ever-lower prices to farmers. Although the government has attempted to put a stop to the arbitrary increase in slaughter fees, farmers remain highly skeptical about the near term prospects for live hog sales under the current marketing system.

The outlook for hog farmers for the remainder of 1999, and perhaps even into 2000, is bleak. Growth in the overall economy is not improving. Price deflation has spread across the entire economy, and the government has not been able to rekindle domestic demand. The lag in increasing pork output due to the time needed to fatten a hog means that pork production is unlikely to recover until some time in 2000, at the earliest.

Fresh eggs and poultry meat: Urban retail prices for eggs declined sharply during 1997 (figure 10). After briefly recovering in late 1998, egg prices fell back to the lowest levels of 1997. However, some livestock analysts in China believe that egg prices have bottomed out and will rise mod-

Figure 9
Pork, hog, and feeder pig prices



Pork prices are urban retail; hog and feeder pig prices are rural free market.
Source: China, Ministry of Agriculture, Information Center.

estly by the end of 1999. Eggs are a cheap source of protein, and in the current pessimistic consumer climate, egg and poultry meats may be substituted for relatively more expensive red meats.

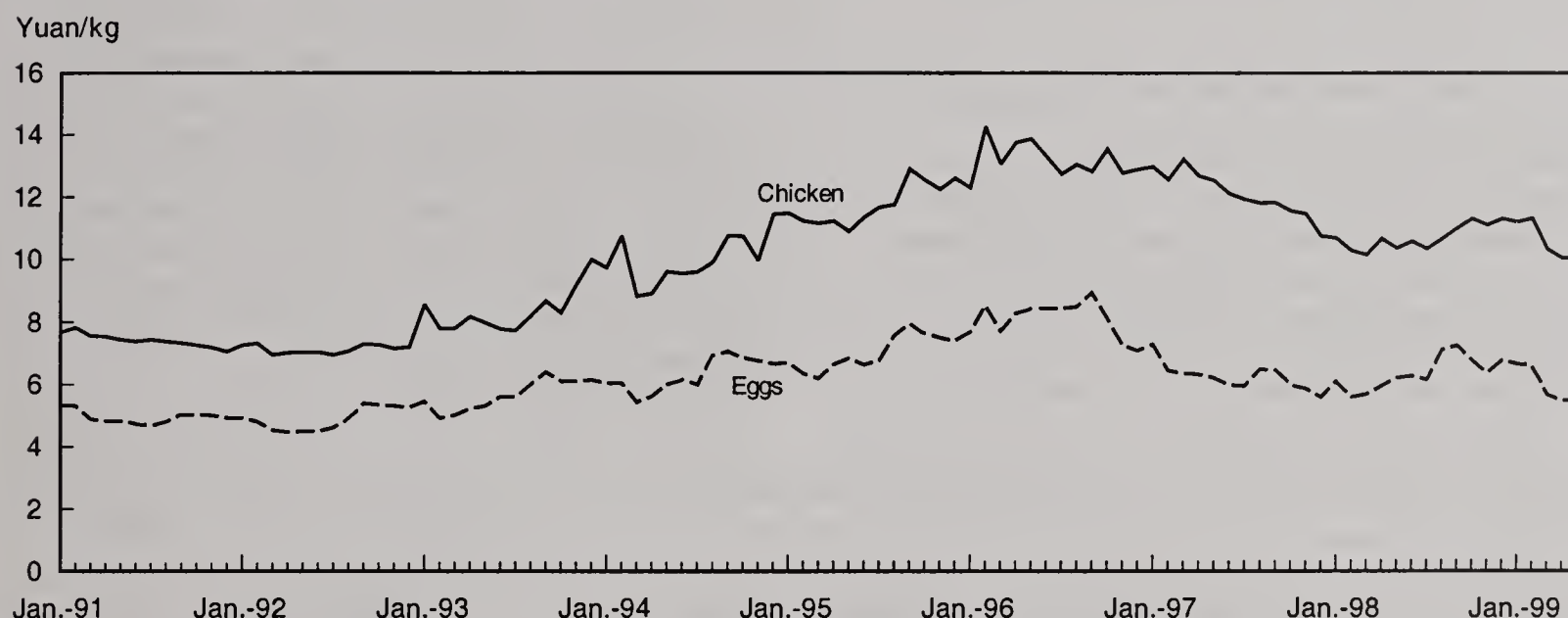
Poultry meat prices have followed essentially the same path as egg prices over the last few years (figure 10). However, poultry meat prices are not projected to increase during the remainder of 1999 because purchase orders of live birds and chicken meats for shipment to Hong Kong and Japan look dismal. Unlike pork production, poultry meat and egg output can respond relatively quickly to changes in demand.

Therefore, when price signals change, poultry meat production will recover quickly.

Beef and mutton: Beef and mutton constitute about 12 percent of China's total meat output. Despite falling incomes during 1998 and the first part of 1999, some consumers continue to diversify their meat consumption beyond the traditional focus on pork. Compared with the situation for hogs and pork, prices for live cattle and sheep and retail prices for beef and mutton have remained relatively stable over the last several years, and are expected to remain so for the rest of 1999 (figure 11). However, if consumer income growth does not begin to recover, or if price deflation con-

Figure 10

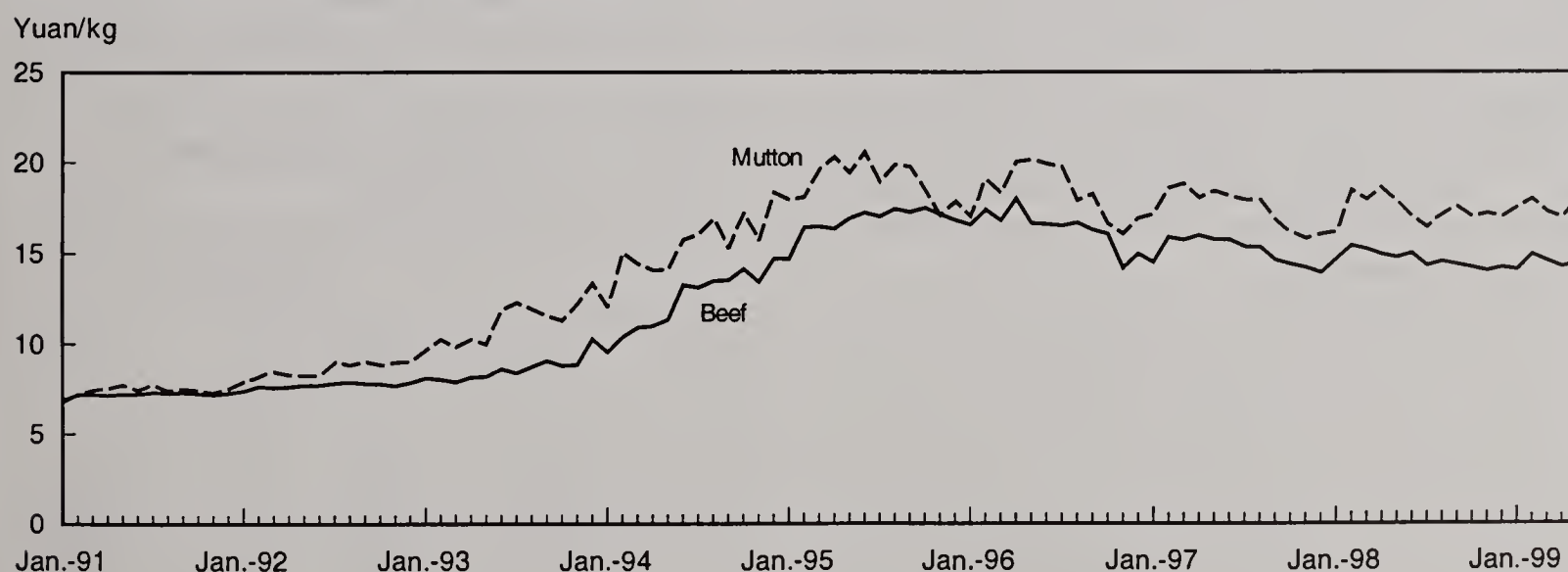
Urban retail prices for chicken and eggs



Source: China, National Bureau of Statistics and Price Bureau.

Figure 11

Urban retail prices for beef and mutton



Source: China, National Bureau of Statistics and Price Bureau.

tinues at its current pace, the markets for mutton and goat meat may suffer as consumers substitute lower priced pork, poultry, and eggs.

China's Meat Exports Expected To Grow in 1999

China's livestock product trade has developed very slowly over the last 20 years. Currently, China exports only about 5 percent of its poultry meat output and 1 percent of its pork and beef output. Mutton exports as a share of total output are a tiny 0.1 percent. Export markets are very localized, with most shipments going to China's closest neighbors—Hong Kong, Japan, and Russia (table 9). Poultry meat trade, on the other hand, has grown rapidly over the last 10 years. Poultry meat exports are primarily chicken thighs, chicken breasts, and whole chickens, while imports are primarily wings, feet, and giblets.

In the early 1990's, chicken exports rose rapidly in response to premium prices received for chicken parts and cuts. Chicken breasts (and other cuts) were exported to Europe, and chicken legs to Japan, while chicken giblets stayed in the domestic market. However, in the last few years, disease (avian flu) and toxic residuals found in chicken meat reduced China's poultry exports. In addition, in the last couple of years Thailand has eroded China's share of the chicken leg market in Japan, largely because of the drastic

devaluation of the Thai currency during the Asian financial crisis. Prospects for China's poultry exports are now improving as Asian markets gradually recover. Assuming that no new disease or contamination problems arise, China's poultry and poultry meat exports are expected to continue their slow recovery during 1999 and into 2000.

China's shipments of live hogs and carcasses went almost exclusively to Hong Kong and Russia. China ships 2-3 million head of live hogs a year to Hong Kong and Macao—traditional and relatively stable markets. In contrast, exports of hog carcasses to the Russian market have steadily declined since 1996, primarily because of the financial crisis, falling Russian income, and stricter sanitary and inspection regulations.

Although China's red meat imports remain extremely small relative to domestic production, there have been some recent gains in U.S. exports of pork cuts and offals. The value of U.S. frozen pork and pork offal shipments to China rose from only \$616,000 in 1997 to more than \$6.3 million in 1998. In contrast, U.S. poultry meat and giblet exports to China, although still huge relative to red meat exports, are declining. The value of these exports has fallen from \$123 million in 1996 to \$59 million in 1998 as China's production has increased and as income-driven demand for higher-priced imported products has slackened.

Table 9--China's livestock and meat trade performance is mixed, January-July, 1999

Commodity	Quantity January-July 1999	Change from January-July 1998	Major markets or suppliers
		<i>Percent</i>	
Exports			
Live poultry	25.8 million birds	48	92 percent to Hong Kong
Live hogs	1.13 million head	-12	Hong Kong, Macao
Poultry meat	191,759 tons	22	70 percent to Japan
Pork	26,675 "	-67	Russia, Hong Kong
Beef	9,705 "	-67	Russia, Hong Kong
Mutton	624 "	398	88 percent to Hong Kong
Imports			
Poultry meat	414,605 tons	504	United States, Brazil
Pork	17,874 "	95	Netherlands, Canada, United States
Mutton	5,601 "	12	New Zealand

Source: *China Customs Statistics*.

China's New and Improved Cotton Market

Lower production, higher consumption, and rising exports during 1999/2000 are expected to cause China's ending stocks to decline for the first time in 6 years. Lower prices and excess supplies are forecast to reduce production 15 percent from the year before—to just over 3.8 million tons—as farmers respond to the end of guaranteed prices. At almost 4.5 million tons, consumption is forecast only slightly higher in 1999/2000 because of the constraints of fierce global textile competition and sluggish domestic consumer demand. Net exports are also forecast to rise, but debt-encumbered stocks and current low world prices will significantly impede radical trade adjustments. [Hunter Colby (202) 694-5215, Stephen MacDonald (202) 694-5305; whcolby@ers.usda.gov, stephenm@ers.usda.gov]

In a significant break from the past, China began the 1999/2000 crop year with no official procurement price, intending instead to let market conditions determine the price of cotton and ending the long-standing state-monopolized purchase and sale system. Years of mounting cotton surpluses and growing textile industry losses compelled the government to finally extend to cotton the liberalization extended to the rest of agriculture for a decade or more. The state monopoly on cotton purchasing and pricing, originally designed to ensure the development of China's textile industry in the context of a centrally planned economy, failed to allow the sector to adapt to the fluctuating prices of competing crops and changing global economic conditions.

China's government realized it was backed into a corner this year as cotton farmers continued to raise more cotton than planners wanted, government-held stocks strained physical storage capacity and financial resources, and consumption weakened in the face of declining textile exports and soft domestic demand (table 10). Export and domestic demand were lower in large part because of the Asian financial crisis. The world market answered China's earlier large cotton export tenders with plummeting prices. As a result, government subsidies required to export excess supplies became prohibitive, further limiting the government's future policy options. Several years of minor policy and price adjustments and administrative pressures on local officials to reduce area

had failed to tame the mounting problems and costly inefficiencies in the government-controlled cotton system.

The final attempt to retain the government-controlled cotton system but reduce cotton's domestic price and production occurred in April 1998 when the government lowered the standard cotton procurement price from 14,000 Renminbi (RMB) per ton to 13,000 RMB (table 11). In Xinjiang province, China's largest cotton producer, the price was reduced even further to 11,400 RMB per ton. And for the first time a modest degree of flexibility was introduced in the form of a 5-percent purchase price fluctuation band.

China also increased enforcement of regulations designed to minimize imports, adjusted tax rebates for exports, and offered targeted export subsidies sufficient to permit significant exports of Xinjiang cotton. Imports fell 80 percent, and China became a net exporter for only the second time in more than a decade.

Despite these changes, problems in the cotton sector worsened during the 1998/99-crop year, prompting government leaders to accept a much more radical transformation of the state-managed cotton system. At the June 1999 National Cotton Conference, Premier Zhu announced that the government had decided to drastically reform the cotton purchase, pricing, marketing and distribution systems. The reforms were implemented on September 1, 1999, for the 1999/2000-crop year. The key provisions of the reforms are:

Market Pricing Introduced—The government no longer mandates cotton procurement or sales prices. Instead, it will announce a non-binding guidance price based on its determination of market supply and demand, production costs, competing crop prices, and world cotton prices. However, the guidance price is non-binding and is not intended to impede the free determination of prices by cotton buyers and sellers on the open cotton market. Government documents describe the new system as one where “the price is oriented by the market under the guidance of the government.”

Table 10--China's cotton production, trade, and stocks, 1997/98-1999/00

Item	1997/98	1998/99	1999/00
<i>Million tons</i>			
Production	4.59	4.51	3.83
Imports	0.40	0.08	0.03
Exports	0.01	0.15	0.26
Stocks	3.67	3.80	2.94

Source: USDA, *World Agricultural Supply and Demand Estimates*.

Table 11--China's cotton procurement and mill acquisition prices^{1/}

Year	Unified government procurement price	Unified government procurement price 2/	Mill ginned cotton acquisition price	Cotlook A-Index 3/
	<i>Yuan/kilogram</i>	<i>U.S. cents/pound</i>	<i>Yuan/kilogram</i>	<i>U.S. cents/pound</i>
1989	4.72	25.89	5.10	82.34
1990	6.00	32.91	6.48	82.87
1991	6.00	32.91	6.48	62.90
1992	6.00	32.91	6.48	57.74
1993	6.60	36.20	7.28	70.69
1994	10.88	59.67	12.16	91.35
1995	14.00	76.79	17.10	85.55
1996	14.00	76.79	17.10	78.58
1997	14.00	76.79	17.10	72.17
1998	13.00	71.31	Not available	58.23
1999	Abolished	Abolished	Abolished	47.62

1/ China Cotton and Jute Company prices for standard roller gin cotton.

2/ Conversion factors: \$1US = 8.27 yuan; 1 metric ton = 2204.6 pounds.

3/ The "A" index is an average of the lowest 5 quotations from a selection of the principal upland cottons traded internationally, compiled by the editors of *Cotton Outlook*.

Source: China, Bureau of Cotton and Jute; A-Index from *Cotton Outlook*.

Cotton Exchange Established—China's National Supply and Marketing Cooperative (SMC) Federation opened a national cotton exchange in Beijing in September 1999. The exchange will provide a market for authorized cotton firms, textile enterprises, and cotton import or export companies to buy and sell cotton. Only domestic enterprises will be allowed to participate on the exchange. Also, the government, through the Cotton and Jute Corporation (CJC), will buy and sell state-owned cotton reserves on the exchange in order to influence cotton supply, demand, and price.

State Purchase Monopoly Eliminated—The Cotton and Jute Company's (CJC) monopoly over cotton procurement will end and state subsidies towards all future CJC operations will cease. Cotton ginning enterprises under the Ministry of Agriculture, state farms, and—in a new development—a limited number of large, state-owned spinning mills or textile enterprises will be authorized to legally purchase cotton directly from farmers or cooperatives. Textile enterprises will be allowed to contract with government-certified cotton processors for ginning and baling. However, it is unclear how much competition will be allowed in the domestic market because individual cotton merchants and uncertified mills will continue to be officially prohibited from buying, processing, or operating cotton-related businesses. Certification of enterprises will be the responsibility of provincial Industry and Commerce Administrations and local Bureaus of Technical Supervision.

Grading Standards Improved—As part of the government's push to improve cotton quality, the China Fiber Inspection Bureau is implementing new cotton grading standards that

will replace the current set established in 1972. Once implementation is complete, the grading standard will include four measures—grade, length, micronaire³, and trash. The first changes were made during the fall of 1999.

State Cotton Trading Monopoly Remains—The government will continue to monopolize all cotton imports and exports. CHINATEX (China National Textile Import and Export Corporation), the Xinjiang CJC, and Xinjiang's Production and Construction Corps are currently the only authorized state trading companies for cotton. However, government policy generally will focus on encouraging domestic textile enterprises to consume domestic cotton in lieu of imports. Cotton imported to produce products destined for re-export will face additional scrutiny in order to prevent this cotton from leaking onto the domestic market.

Reduce Cotton Area—The government hopes that lower prices will reduce cotton area and output over the next several years. Most importantly, the recent rapid growth in cotton area in Xinjiang province will be scaled back. The targets are for sown area in Xinjiang to remain stable and for sown area in the northern and central provinces to continue to decline.

Moratorium on New Cotton Ginning Enterprises—No new cotton ginning operations can be constructed, and the current policy forbidding the sale of used ginning equipment or spindles will continue.

³ Micronaire measures cotton fiber fineness and maturity.

Spindle Reduction—China seeks to reduce the number of cotton spindles in its textile mills by 10 million within the next few years. As recently as 1998, China had 42 million cotton spindles and regularly undertook campaigns to reduce this number as the profitability of state-owned mills plummeted. Millions of spindles were reportedly eliminated during 1998 and the first half of 1999, raising the prospect that China might actually reach its reduction target.

If all of the reforms envisioned for China's cotton sector are successfully implemented, China will have a drastically different domestic cotton market in a very short period. In the immediate future, cotton farmers are likely to suffer falling prices and decreased incomes. If the government's initial guidance price for the 1999/2000 crop of 10,000 RMB is accurate, cotton returns will be reduced roughly 2,500 RMB per ton or 25 percent. Lower cotton prices are expected to increase the competitiveness of China's textile exports. Lower prices may also increase domestic consumption as lower costs mean cotton is better able to compete with synthetic fiber. The legalization of alternatives to the government's official cotton procurement system could introduce profound changes in the distribution of China's cotton. These and other long-range impacts of the reforms,

however, hinge on the successful implementation of the reforms as announced.

China attempted a similar liberalization back in 1993 that collapsed almost immediately as soaring grain prices and a severe bollworm infestation throughout the North China Plain devastated cotton production. It remains to be seen if this newest round of reform can survive the impacts of falling farm returns during 1999/2000 and the unforeseen problems likely to follow.

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Livestock Production Slowly Evolving from Sideline to Principal Occupation

Livestock feeding in China has changed significantly since the mid-1980s, because of market liberalization and because the objectives of raising livestock have shifted. China's rapid growth has magnified demand for livestock products, mainly pork. Although meat and eggs still are produced predominantly by farmers raising a few pigs or chickens as a sideline, an increasing share is provided by households specializing in livestock as their principal occupation. Specialized households rely far less on homegrown grain and farm byproducts, and are more responsive to grain prices, than traditional "backyard" operators. Meat quality and feed efficiency are increasingly important goals. [Cheng Fang,⁴ (515) 294-6357, Frank Fuller,⁴ (515) 294-0470, Michael Lopez (202) 694-5213, and Francis C. Tuan (202) 694-5238; cfang@gcard.iastate.edu, ffuller@gcard.iastate.edu, mlopez@ers.usda.gov, ftuan@ers.usda.gov]

China's Traditional Feeding Practices

Chinese records trace domesticated livestock back more than 6,000 years (Cheng, 1999). Despite this long history, China's livestock industry only began to develop rapidly in the mid-1980s. Even today, most meat is produced with traditional "backyard" methods, on a very small scale, by farm households raising animals to supplement their regular income.

As recently as the early 1980s, most of China's domestic animals, including hogs, cattle, goats, sheep, and chickens, were fed in the backyards of farm households. Hogs ran free or were kept in small pigsties that were partially roofed and held at best a few hogs. Cattle, goats, and sheep were either fed in small pens or herded along the sides of roads and edges of fields, where they could eat weeds.

Before 1980, cattle were raised primarily for plowing, and manure was a valuable byproduct of animal husbandry since manufactured fertilizer was scarce. Under these circumstances, the composition of feed in China was quite different from the formula feed used in the United States. Depending on the type of animal, feed ingredients generally included low-quality grains, tubers, grain byproducts, table scraps, brewery residues, green silage, melons, water plants, and other vegetation. Oilseed meals were then employed mainly as fertilizer. Soybean and rapeseed meals were put to use as protein feed only later, and then only gradually, beginning around the mid-1980s.

Structural Changes in the Livestock Sector

The Chinese Communist Party, which came to power in 1949, reorganized agriculture along Marxist lines in the

early 1950s, transferring almost all property from households to government controlled entities. From the mid-1950s through 1979 the ownership and care of most large animals, particularly hogs and cattle, was assigned to state farms and collective farms. In the late 1970s the government began to reverse course, incrementally transferring assets and control back to households. In 1980, after it had permitted farm households to privately specialize in growing grain, the government began to encourage households to privately specialize in raising livestock.

In the aftermath of China's widespread economic liberalization, economic growth in the 1980s and 1990s has been phenomenal, averaging 9 to 10 percent per year. That significantly changed food consumption patterns, especially in urban areas. Diets shifted towards more animal protein and less grain-based starch. Consumers also developed a taste for leaner pork. These changes encouraged China's farmers to adopt better breeds and more efficient feeding practices, especially for the two most popular sources of animal protein, hogs and poultry.

More fundamentally, the structure of animal husbandry began to evolve into three main patterns in the mid-1980s: part-time household operations, called "backyard feeding;" full-time household operations, called "specialized households;" and large-scale commercial operations, a mix of state farms, joint ventures with foreign firms, and Chinese private companies. The changes started in the hinterlands of large cities, then diffused across the countryside. The transition is still underway. At present, about 80 percent of pork output comes from backyard feeding, 15 percent from specialized households, and 5 percent from large-scale commercial operations (table 12).

⁴ Associate Researcher, Center for Agricultural and Rural Development, Iowa State University.

Table 12—Share of pork output by production type

Year	Backyard feeding	Specialized households	Commercial operations
<i>Percent</i>			
1985	94.6	2.9	2.5
1993	88.3	8.2	3.5
1996	80.7	14.6	4.7

Source: Wailes et al, "China's Livestock Feed Use Relationships," 1998.

Traditional or Backyard Feeding

The essence of backyard feeding is that it is a part-time operation, carried out on a very small scale. Each household feeds one to several pigs (rarely more than four per year), or up to a few dozen chickens. Most of the materials fed are produced on farm, often as byproducts. Originally, backyard feeding was mostly for on-farm consumption, and about a quarter of this sector's output still is consumed by the farm households creating it.

On average, a hog raised in a farm household's backyard eats from several hundred to over 1,000 kilograms of water plants, vegetables, tubers, sweet potato leaves, carrots, pumpkins, crop stalks, and table scraps before it is slaughtered. In 1997, such vegetation still comprised nearly a fifth of total feed consumption in backyard hog operations, according to a large survey of producers in seven Chinese provinces. Hogs also are fed grains (mostly corn, broken rice, barley, sorghum, and oats) and grain byproducts (mostly wheat bran, rice bran, and rice hulls). Households often supplement homegrown grain with purchased feed grains. Finally, various meal products from soybeans and peanuts, as well as smaller amounts of cottonseed meal, rapeseed meal, fish meal, cocoons, bone meal, and bone powder, are used as supplemental sources of protein or minerals (Chang, 1957; Li, 1983; Wailes et al., 1998).

Specialized Household Feeding

Specialized livestock households allocate most of their farm labor to producing one or two kinds of livestock products—usually hogs, chickens, or a combination of the two—which provide the bulk of their income. (Cattle, sheep, and goats are mainly grass-fed.) A typical specialized household raises 200, 500, or even 1,000 chickens a year, or feeds from 20 to 100 hogs. More highly specialized households keep one or two sows to breed to produce feeder pigs, which they sell to other producers for fattening.

Unlike backyard operators, specialized households now rely heavily on purchased grain and compound feeds. They are more likely to use different blends of feed for different stages of growth, especially for chickens.

Several policies encouraged the emergence of this more modern part of the livestock sector. The government fostered the creation of feed mills, whose output allowed households and large-scale commercial operations to specialize in feeding livestock without having to produce most of the feed ingredients themselves. By revitalizing rural livestock markets and decontrolling meat and egg prices, the government enabled specialized operations to produce better quality products than backyard operations, and sell them at a higher price. County breeding farms started to produce lean-meat hogs. Policies favorable to livestock development are described in greater detail in last year's China Report (Tuan, Zhang, and Wailes, 1998).

Large-Scale Commercial Operations

State farms, joint ventures between Chinese and foreign corporations, and privately owned feed lots commercially raise hogs, cattle, and poultry. Hog and poultry feeding practices, based on manufactured feed, are similar to commercial operations in developed countries. However, hog and chicken farms in China are not as large nor as geographically concentrated as those in the United States. In general, large-scale commercial livestock operations are found around big cities and in major feed grain producing provinces, such as Jilin.

Analysis of Feed Grain Demand by Backyard and Specialized Households

In 1997, the Research Center for Rural Economy of China's Ministry of Agriculture, assisted by staff from the University of Arkansas, Iowa State University, and the Economic Research Service, administered a feed consumption survey to more than 4,000 households in seven Chinese provinces. The provinces, which had collectively produced 45 percent of China's pork output in 1996, were selected to capture a cross section of the country's livestock production practices. By obtaining detailed information about each household's annual livestock production, feed use, labor inputs, grain production, and prices, the survey provided an unprecedented opportunity to analyze Chinese farmers' animal husbandry (Wailes et al., 1998).

One such analysis (Fuller and Fang, 1999) compared the determinants of feed grain demand for backyard and specialized households. The study found that backyard pork and poultry producers' responses to changes in feed ingredient prices are very inelastic, with absolute values of 0.25 or less (table 13). Backyard operators are insensitive to commercial feed prices because they grow most of the grain that they feed to livestock and create, as byproducts to their regular farming, most of the oilseed meal and over four-fifths of the bran used in their operations (Fang and Fuller, 1998).

Specialized livestock households, in contrast, purchase most of the feed that they use. Consequently, they are much more responsive to changes in grain prices than backyard producers. The generally positive " albeit often small and statisti-

Table 13--Elasticities of demand for feed grains, in backyard feeding and specialized households

Elasticity of feed grain demand 1/ 2/ 3/	----- Backyard feeding -----		----- Specialized households -----		
	Pork	Poultry meat + eggs	Pork	Poultry meat	Poultry eggs
Elasticity with respect to:					
Grain price index	-0.254 (-4.2)	-0.128 (-2.1)	-0.661 (-1.2)	-0.502 (-1.7)	-0.322 (-1.5)
Oilseed meal price	0.191 (-4.9)	0.211 (-4.6)	0.172 (-0.5)	<i>0.441</i> (-1.9)	0.124 (-1.2)
Bran price	0.063 (-1.2)	-0.082 (-1.7)	0.490 (-0.8)	0.060 (-0.2)	0.199 (-1.3)
Output of meat or eggs	0.816 (-31.0)	0.684 (-28.1)	0.886 (-14.2)	0.940 (-19.7)	0.877 (-18.0)
Household's grain output, per capita	0.103 (-4.0)	0.036 (-2.3)	--	--	--
R-squared (percent)	49.1	55.0	55.7	90.2	87.5
Number of observations	1,896	2,005	112	69	76

-- = no coefficient, since variable not included in regression equation

1/ t-statistics are in parentheses.

2/ Bold denotes coefficient significant at 5 percent level. Italics denotes coefficient significant at 10 percent level.

3/ Regressions also included an intercept term and 6 dummy variables representing provinces; those coefficients are not shown above.

Source: Fuller and Fang, "The Impact of Structural Changes in Chinese Livestock Production on World Feed Grain Trade," 1999.

cally insignificant " coefficients for oilseed meal and bran prices indicate that Chinese households substitute oilseed meal and bran for feed grains as relative prices change. Lastly, the coefficients for a set of province dummy variables (not shown in table 13) are evidence of significant regional variations in feed grain demand.

Table 14 more closely examines the hog feeding practices of three sizes of backyard operators, in comparison with specialized households. Recalling that the specialized households generally raise from 20 to 100 hogs per year, the extremely small scale of traditional animal husbandry is evident, with 92 percent of backyard operators raising four hogs or less per year, and the majority raising only one or two! Yet four-fifths of China's pork is produced in this way, as a sideline.

Also evident is that the larger traditional backyard pork producers behave more like the specialized households, in part because they feed more grain than they can produce on farm. The table shows regular progressions as the scale of operations increases: less green vegetation and waste products such as table scraps, less bran, more oilseed meal, greater use of compound feed to supplement unprocessed

grains, and more premixed feed additives. The most striking feature is the reduction of average time on feed as the number of hogs increases, from 230 days in the smallest ventures to 152 days in the specialized households.

Ironically, the smallest operations, which feed the least grain per hog per day, feed the greatest amount of grain per kilogram of live weight at slaughter, because it takes such a long time for their animals to reach market size. However, most of their feed ingredients are "free" in the sense that they involve no cash outlay, and the labor that family members put into the endeavor is also unpaid. The cheapness of the inputs, unfortunately, is reflected in the quality of the fatty pork that they produce, which is little appreciated in urban markets.

The empirical results suggest that feed demand per hog in China decreases as household production rises from subsistence levels to more than 500 kg per year. Producers accomplish the reduction by substituting more formula feed and oilseed meal for less nutritious feeds. However, as household output continues to rise above 500 kg, more grain is needed to capture the production efficiencies embodied in modern techniques. Reducing the number of days on feed

Table 14--Characteristics of specialized households and backyard pork operations, by size

Item	Backyard feeding operations by annual output**			Specialized households
	<200 kg	200-500 kg	>500 kg	
Characteristics of backyard operators				
Pigs raised/year	1 or 2	3 or 4	5 or more	NA
Portion of backyard operators (percent)	51.5	40.2	8.3	NA
Feed ingredients				
	Percent of feed weight			
Green feed + waste products (dry weight)	18.9	18.0	21.7	12.9
Bran (wheat, rice)	37.1	30.8	20.3	17.4
Oilseed meals	0.8	1.2	1.8	4.2
Unprocessed grain	39.9	42.6	46.3	38.3
Compound feed	3.0	6.8	8.6	24.5
Premixed additives	0.3	0.5	1.2	2.7
Total	100.0	100.0	100.0	100.0
Unprocessed grain fed to animals /				
	Ratios			
Grain grown by household	0.19	0.27	1.14	1.98
Total grain fed* /				
Kilograms of hogs produced**	2.53	2.00	2.15	2.06
Average time on feed				
	Days			
	230	218	183	152

NA = Not Applicable

* Total grain is calculated as unprocessed grain + 0.7 x compound feed.

** Live weight.

Source: Calculated by authors based on data from Livestock Survey (1997) conducted by China, Ministry of Agriculture, Research Center for Rural Economy.

can decrease the total quantity of grain required for an animal to reach slaughter weight, but a higher grain ration is often chosen to further increase the rate of weight gain. Thus shortening the number of feeding days can either augment or diminish feed grain efficiency.

Beyond the details of statistical data and regression equations, a broader picture emerges. China's future demand for feed grains and meals will depend not only on how much pork, chicken meat, and eggs are produced, but also on the continuing evolution of how and where they are produced—as a sideline of largely self-sufficient farm households, or as the principal occupation of specialized households and large-scale commercial operations.

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China's Feed Manufacturing Industry Is Booming

China's feed manufacturing industry is now the world's second largest, with an output of 66 million tons in 1998, after growing at an average annual rate of 15 percent since 1990. Producers are switching from traditional feeding techniques to purchasing mixed feeds as commercial chicken and hog farms gain larger market shares. A modest increase in per capita meat consumption in China could translate into a large additional demand for manufactured feeds, and more feed production or more feed ingredient imports from the United States and other sources. [Hsin-Hui Hsu (202) 694-5224, hhsu@ers.usda.gov, and Frederick W. Crook (703) 759-7197, fwcrook@erols.com]

Introduction

China's feed manufacturing industry is expanding rapidly. It is now the world's second largest, with an output of 66 million tons in 1998, after growing an average of 15 percent a year since 1990. The industry is becoming bigger and more efficient as old, small, inefficient mills close and new, larger mills open. China's livestock production is gradually specializing into breeding, feeding, and marketing operations. The complexity of raising animals and selling them in liberalized markets has become a new challenge for China's animal producers. New mills often use improved technology and management skills that were acquired from foreigners in joint ventures, and adapted to local needs.

China's feed manufacturing industry has developed in line with the evolving needs of its animal producers. Livestock production is gradually shifting from a part-time activity using unpaid household labor to feed a small number of animals with mostly farm waste and byproducts, into a full-time occupation feeding relatively large numbers of animals with mostly purchased feedstuffs. The adoption of manufactured feeds allows the transition to a bigger scale of operations, and it facilitates production of the higher quality meat desired by consumers with rising incomes.

China has emphasized self-sufficiency in grain production, and it probably will continue to resist importing bagged complete feeds. However, it is likely to expand imports of non-grain feed ingredients, such as protein meals and feed additives. From 1992 to 1998, soymeal, fishmeal, feed grade lysine, and methionine were among the largest import items for the feed industry. At present, China's domestic production and marketing of manufactured feeds has been liberalized, but the production and marketing of the principal feed ingredients, such as grains, remain under tight government control. Imports, exports, and internal trade of protein meals are fully liberalized, trade of feed ingredients such as soybeans is partially liberalized, and trade of corn is totally under government control.

Emergence of Feed Mills in China

Little Feed Manufacturing Through 1975

China's farmers have had over two millennia of experience in feeding a wide variety of livestock. Traditional feeding materials included bran, vegetables, crop residues, table scraps, grains, and tubers. In the 1930s, farmers in coastal areas began to use wheat bran that became available with the development of modern flour mills. If a "modern feed mill" is defined as one that uses power-driven machinery to store, move, crush and mix ingredients, and prepares feeds for final use, China did not have a modern feed industry before 1949.

The government instituted the "planned purchase and planned grain supply system" in the mid-1950s. Central authorities planned grain production, and Grain Bureaus were established to purchase, transport, store, mill, and retail grains and grain products, largely for urban and military use. This system dramatically increased the quantity of grains controlled by the state. Large rice mills were constructed in urban areas to process paddy rice, increasing the availability of rice bran for feed use. Also in this period farmers in Guangdong province established the first small shops to crush feed grains.

From 1959 through 1975, China endured a period of radical political campaigns that disrupted economic growth and development. The Great Leap Forward (during the Second Five Year Plan 1958-62) reduced grain production so much that almost all grain was consumed by people, as millions of citizens were dying from starvation. Largely because of the paucity of feed, livestock product output plummeted during these years (see China: International Agriculture and Trade Report, 1998, "The Effects of Government Policies on Animal Protein Production and Consumption" for details).

When animal production revived after the "Great Leap Forward," traditional feeding methods and technologies still predominated. Political movements such as the "Socialist Education Movement" (1963-1965) and the "Cultural Revolution" (1965-1975) continued to curb the development of the feed industry.

Feed Industry Terminology

Chinese-language documents, including the Ministry of Agriculture's National Feed Industry Office, use the following terms to describe feed.

✱ Compound feed (*Peihe siliao*)

This feed contains energy components (mostly grains), protein components (mostly oilseed meals), and feed additives (vitamins, trace minerals, and drugs), providing 100 percent of an animal's needs. It is equivalent to a complete feed in the United States.

✱ Concentrate feed (*Nongsuo siliao*)

This kind of feed is made by adding protein components, plus supplementary minerals as needed, to premixed feed. The ingredients in concentrate feed constitute 15-35 percent (by weight) of the materials in a complete, compound feed. China's farmers often feed their animals purchased concentrate feed, which they combine with various home-grown ingredients for the energy component.

✱ Premixed feed (*Yuhunhe siliao*)

This feed, roughly similar to premixes in the United States, is made from vitamins, trace elements, and drugs, bound into an edible carrier to facilitate uniform mixing. These ingredients constitute 0.3-2 percent of a complete (compound) feed.

✱ Additives (*Tianjiaji*)

Ingredients such as vitamins, trace elements, and drugs.

✱ Mixed feed (*Hunhe siliao*)

Small feed mills and individual farmers can mix their own blends of grains for energy components, sometimes also including oilseed meals as protein components. This feed is roughly similar to formula feed in the United States, although it is not always scientifically proportioned or even uniformly mixed. The ingredients usually provide more complete nutrition than the 15-35 percent of concentrate feed, but less than the 100 percent of compound feed.

Dramatic Change Occurred from 1976 to 1985

During the Fifth Five Year Plan (1976-1980) and the Sixth Five Year Plan (1981-1985), China's leaders shifted basic policy directions from heavy reliance on central planning, limited involvement with foreign trade, and an emphasis on autarky, to greater reliance on the use of markets, greater involvement in world trade, and a greater willingness to adopt ideas, technology, institutions, and equipment from the rest of the world. These fundamental shifts had pronounced effects on the development of China's feed industry. The government supported rapid development of the feed milling industry, citing these benefits:

- ✱ Compound feed will shorten the time animals are on feed and requires less feed per kilogram of product.
- ✱ The increased output of animal proteins will improve the nutritional level of China's citizens.
- ✱ The increased use of compound feed will support the development of the livestock industry, which in turn will improve farm income.
- ✱ Other countries in Asia, Europe, and North America developed modern feed industries that added wealth to their economies by providing employment, valuable byproducts for food processing industries, and improved

nutrition. The sustained development of animal protein products increased rural incomes.

Concurrent changes in rural institutions and in the general economy supported the growth of the feed industry. First, changes in production conditions allowed farmers to earn a profit and retain profits from raising livestock. Rural People's Communes, which had rigidly controlled all aspects of rural life, were disbanded. They were replaced by townships and villages that permitted farmers much greater flexibility in their economic decision making. The newly established household production responsibility system and the reformed land contract system encouraged farm families to maximize their income. These changes at the farm level provided farm families with the flexibility and the incentives to raise more livestock.

Second, there were changes in marketing systems. Previously, the State was responsible for purchasing most agricultural products, but with reforms, rural and urban markets were reopened, giving farmers a source to purchase feed and an outlet to market their livestock products.

Third, changes in the general economic system supported a growing supply and a growing demand for animal protein products. Urban incomes increased rapidly. Incomes in rural areas increased too, though at a more moderate rate. The

higher incomes encouraged consumers to purchase more animal protein products. The greater demand for livestock products in turn stimulated the demand for processed feed. Meanwhile, the lifting of trade and travel barriers permitted enterprises to import key feed ingredients, technology, and equipment. The more relaxed reform atmosphere also allowed technicians from China to travel to other countries to gain experience and become familiar with animal nutrition and feed milling technology. The reforms also allowed foreign firms to set up modern feed mills in partnership with firms in China.

Government Support for the Feed Industry

China's feed industry grew from practically nothing in 1975 to one of the world's largest producers within two decades. Government leaders took an active role in this dramatic change by placing feed industry development high on the country's agenda, and formulating long range and annual plans for it.

In 1984, the State Economic Commission drafted a feed industry development program entitled "A Draft of an Outline for the Development of the National Feed Industry for the Period 1984-2000." Short term feed development goals were included in the Sixth through the Ninth Five Year Plans. From year to year government and party officials issued directives and policy statements to make sure that all parts of the feed industry worked together. Authorities understood that their success would depend on relating feed mills to other institutions and disciplines: the physiology of animal feeding, biotechnology (animal breeding), animal husbandry, sources of feed ingredients, transportation, and marketing. They issued policy directives that established manufacturing facilities to build feed mill equipment, and they ordered that feed additive standards be developed. The central government also directed the State Statistical Bureau (SSB) in 1987 to initiate surveys and adjust the industrial census to gather data on developments in the feed industry.

The government gave tax breaks to feed mills. In 1984, the central government granted several tax breaks for feed mills. New mills were given a 3-year tax break. To encourage a quick expansion of feed mills, China's Customs Bureau ceased levying import tariffs on feed milling equipment and feedstuffs. The Tax Bureau also exempted feed mills from paying profit taxes as a way to enhance commercial sales and business activities. These tax breaks extended through the end of 1995. When the value added tax (VAT) system was implemented in 1993, feed mills were exempted. Spurred by these exemptions and a deficit of domestically produced protein meal, China's soymeal imports swelled from virtually nothing in 1994 to 4.2 millions tons in 1998, making China the world's largest importer.

National, provincial, and local governments invested billions of RMB in feed mills, feed retail outlets, feed testing centers, and extension services. By the end of 1990, the Ministry of Commerce had invested more than 2.7 billion RMB in feed mills, and by 1997, 7.4 billion. The Census of Manufactures reported that in 1995, fixed assets invested in feed mills totaled 11.4 billion RMB. Not all of these investments were accumulated in the 1990s. Foreign investors also invested funds or set up joint ventures with feed mills.

In the early 1980s when central planning was still functioning, the government assisted feed mills by supplying feed grains at favorable prices. When the domestic price of corn rose rapidly in 1995, the government cut corn exports, arranged for corn imports, and used administrative measures to transfer 2 million tons of corn from northeast Manchuria to central and south China.

In 1994, the central government promulgated the "governor's grain bag responsibility system," which resurrected the goal of grain self-sufficiency. The grain bag strategy boosted grain production and made large supplies of cheap domestic feed grains available to feed mills. Foreign trade border measures controlled the import and export of feed grains. Despite these government interventions, the development of the feed industry rested primarily on market prices and not on government fixed prices. The grain bag policies are costly and probably cannot be sustained in the long run. In the coming decades, China is likely to produce most of its feed grains, but will also need to import some.

In 1983, the Ministry of Agriculture called for the establishment of national and provincial offices to test the quality of animal feed. By 1987, a national office and 32 local feed testing centers had been established. Also in 1987, the National Bureau of Standards approved 12 feed additives for use throughout the country. In 1993, the Ministry of Commerce had published a draft of feed standards and had established two inspection stations, one in Shanghai and one in Harbin. In 1996, the government had established standards for compound and mixed feed, feed packaging, storage, and transportation. Standards also were set for different classes of livestock, i.e., dairy concentrate feed and poultry layers' feed. However, there were no requirements to label bags of feed for ingredients, protein, or mineral guarantees.

The government established factories to manufacture feed milling machinery. In 1976, the Ministry of Agriculture imported the first complete set of feed milling machinery from Hungary. China imported equipment and technology from 10 countries and 40 different firms. The imported mills included compound, mixed, concentrate, and additive mills. In all, China imported 270 full sets of equipment, valued at U.S.\$200 million.

The Ministry of Machinery assisted in the development of key manufacturing plants. The feed milling manufacturing plants were sponsored by the ministries of Agriculture and

Commerce. By 1990, China had more than 270 firms that were capable of manufacturing feed milling equipment. The output of these firms increased rapidly from 20 complete sets of feed mills in 1980 to 8,000 sets in 1990.

The manufacture of feed grinding machines (i.e., hammer mills) began in the 1950s and by the 1980s the quality of these machines matched world class standards (figure 12). China obtained key machinery and technology to manufacture measuring and weighing devices and pelleting machines from Switzerland, Germany, and the United States in the 1980s. By 1990, China had more than 50 firms manufacturing feed pelleting machines and domestic machinery plants were able to supply measuring and weighing equipment for local mills. Indeed, some complete feed mills were exported to other Asian countries. Before 1990, mills capable of producing concentrate and premixed feeds were largely imported. After 1990, China produced its own mills capable of producing fish, bone, meat, feather, and blood meals. It also manufactured mills to extract toxins from various kinds of oilseed meals.

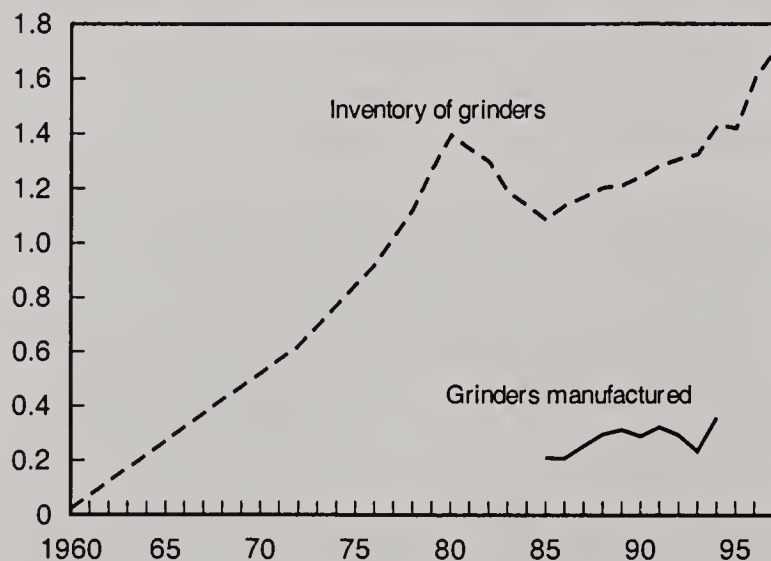
The partial list of government-sponsored activities in table 15 illustrates the active role that the government played in bringing foreign feed technology to China. From no exchanges in technology before 1970, exchanges increased dramatically so that by 1990 more than 100 different business firms and more than 20 countries, including the United States, Thailand, Japan, France, Germany, Switzerland, Singapore, Romania, and South Korea, and investors from Hong Kong and Taiwan, provided technology assistance.

Beginning in the late 1970s, the central government encouraged its research centers to support the burgeoning feed industry. Table 16 summarizes some of the institutes involved in feed research work.

Figure 12

Inventory of feed grinders

Mil. pieces



Source: China, Ministry of Agriculture.

The government also encouraged foreign firms to invest in joint venture mills. By 1990, foreign firms had invested over \$200 million in 66 joint venture (JV) mills in China, with a total capacity of 3 million tons. The mills accounted for about 5 percent of the national double-shift capacity of 59 million tons. The 20 Thai JV mills accounted for more than two-thirds of this capacity. Many of the JV feed mills are integrated enterprises with feed mills, nurseries, grow out, and processing facilities. Officials in China encouraged the development of these mills because they believed their world class milling equipment and technology would stimulate local mills to modernize in order to remain competitive.

The government encouraged or allowed a wide variety of entities to organize feed mills and supporting industries. The Ministry of Agriculture (Animal Husbandry Department, Aquatic Department, State Farm Department), the Ministry of Commerce, and the Ministry of Light Industry all established feed companies. National, provincial, prefecture, and county governments created feed companies and built feed mills. Local township governments and village committees also organized small collectively owned feed mills. In addition, individuals were permitted to set up feed mills. And as noted above, the government also allowed joint venture companies to compete in China's market.

At various times in the past 20 years the government-owned Grain Bureaus did provide feed companies—especially Grain Bureau feed mills—with subsidized grains and feed-stuffs. But it appears that the feed industry in China on the whole has been built on market prices. Feed mills purchase ingredients at market prices and sell feed at competitive prices, while farmers sell their livestock products in open-access local markets.

Government leaders allowed feed firms to enter and exit the market. By the end of the 1980s, reports on the development of the feed industry began to complain of the "blind construction" of feed mills, suggesting overproduction and increasing competition among firms. Reports in the early 1990s indicate that hundreds of feed mills closed because of losses. Significantly, the government did not rush in to shore up the failing companies.

Development of Mills and Feed Output

Feed Mill Numbers Expanded

The number of feed mills in China expanded dramatically from practically none before 1975 to over 14,000 in 1985. Initially, statistics on mill numbers included many small mills producing less than 1 ton per hour. By the 1990s, authorities were counting only firms meeting minimum milling capacity criteria, such as 1 or 5 tons per hour (table 17).

The mills are concentrated in provinces that have major livestock sectors. In 1997, Shandong province had the most feed mills with a capacity of at least 1 ton per hour (table 18). However, for better-developed southern coastal

Table 15—Summary of technology exchanges

Year	Exchange activities
1977	China's first feed research institute organized. Published <i>Feed Studies</i> .
1978	Ministry of Commerce sent its first team to the United States, France, and Japan to study the feed industries in those countries.
1980	Conference held to discuss the use of compound feed for pond fish.
1983	Government organized the Feed Industry Office, the China Feed Industry Technology Expansion Company, and the National Feed Association.
1985	China's Feed Association sent a team to visit the Zhengda company in Thailand and reciprocal visits by Zhengda were made to China.
1986	National conference in Changsha, Hunan province, to discuss the use of feed additives.
1986	Seminars held for feed mill managers and feed mill technicians to help them to operate their mills more efficiently.
1988	The State Council directed that the Feed Industry Office, the China Feed Industry Technology Expansion Company and the National Feed Industry Office be transferred and put under the management of the Ministry of Agriculture.
1988	Monsanto invited to China in 1988 to discuss the use of feed additives.

Source: *China Feed Industry Statistics Yearbook*.

Table 16—Research institutes that have worked on feed problems

Name of institute	Research activities
Institute of Feed	MOA, Chinese Academy of Agricultural Sciences (CAAS), Beijing. The institute has research offices for: animal nutrition, feed additives, feed resources, milling technology, biotechnology, and feed information.
Institute of Animal Science	Organized in CAAS in 1957. Devotes resources to study feeds and nutrition, feed crops and forages, and genetics and breeding (toxins in feed etc).
The National Center for Supervising and Testing Feed Quality	Established in 1988 to draw up standards for feed. It randomly tests feed and feed additives to make products meet quality standards.
National Institute for Control of Veterinary Bioproducts and Pharmaceuticals	This institute is charged with the responsibility to make sure ingredients in feed do in feed do not harm consumers.
Academy of Agricultural Engineering and Planning	The academy under MOA has a charge to develop equipment to process cottonseed and rapeseed for use in feed.
Feed Research and Design Institute	Located in the Bureau of Internal Trade, Research Academy. The institute conducts research on developing feed resources such as use of waste starch residues, fermentation technology, feed formula design (software), feed milling machinery, and feed mill design.
Livestock and Poultry Equipment	Chinese Academy of Agricultural Mechanization Sciences. The institute is to Institute develop feed processing machinery for China.

Source: China Feed Industry Office, *Overview of Feed Industry in China*.

Table 17--Feed mills with a capacity of more than 1 ton per hour, 1991-98

Year	Total feed mills	Ministry of Commerce mills	Ministry of Agriculture mills	Township village mills	Other mills
<i>Number</i>					
1991	9,154	4,062	2,998	1,494	600
1992	11,993	4,278	4,025	2,720	970
1993	10,762	3,461	3,604	2,637	1,060
1994	11,046	3,619	3,497	2,398	1,532
1995	12,678	3,665	3,845	2,942	2,226
1996	13,271	4,100	3,867	3,161	2,143
1997	11,301	3,056	3,190	2,127	2,928
1998	12,435	na	na	na	na

na = not available

Source: *China Feed Industry Statistics Yearbook*.

Table 18--Ranking of China's feed mills and feed production, by provinces, 1997

<i>Ranking by total mills</i>		
	Provinces	Total mills
1	Shandong	1,298
2	Sichuan	796
3	Shanxi	788
4	Hebei	768
5	Hunan	705
6	Hubei	686
7	Heilongjiang	610
8	Jiangxi	564
9	Liaoning	446
10	Henan	442
National total		11,301

<i>Ranking by total output</i>		
	Provinces	Output
<i>Million tons</i>		
1	Guangdong	7.03
2	Hebei	5.64
3	Shandong	5.21
4	Henan	4.13
5	Hubei	3.50
6	Jiangsu	3.42
7	Sichuan	3.40
8	Hunan	3.27
9	Zhejiang	2.72
10	Guangxi	2.47
National total		62.99

provinces, feed mills are relatively large and more efficient. Therefore, when ranked by total output of manufactured feed in 1997, Guangdong is the top producer, with 7.03 million tons from only 247 mills.

Mills Had Many Sponsors

In the 1980s, mills sponsored by the Ministry of Commerce and the Ministry of Agriculture tended to have more modern equipment than other mills and production capacities of more than 1 ton per hour. The number of mills was about equally distributed between the Ministries of Commerce and Agriculture. Within the Ministry of Agriculture, mills were sponsored primarily by the Department of Animal Husbandry. The Aquatics Department established mills to supply feed for pond fishing operations, and the State Farm Department operated its own set of feed mills. The Ministry of Agriculture had over 9,000 small mills in 1989 that produced less than 1,000 tons of feed a year.

In the late 1980s and in the early 1990s, many mills sponsored by the Ministries of Commerce and Agriculture encountered difficulties such as aging equipment, a bloated number of employees, rigid bureaucratic rules, and increasing competition from township and joint venture mills. The number of mills sponsored by the Ministry of Commerce decreased in the 1990s, but the number of mills sponsored by the Ministry of Agriculture increased (see table 17).

Feed mills in townships and villages, often called Township-Village-Enterprises (TVEs), were collectively owned by local farmers and normally supervised by officials from the Ministry of Agriculture. In practice, the local officials initiated and supervised their operations. Many small, inefficiently run TVE mills eventually succumbed to competitive pressures and closed up shop. But local authorities in many other areas were adept at organizing efficient competitive units. Ultimately, the number of TVE mills increased 40

Source: Ministry of Agriculture, *National Feed Industry Statistics Yearbook*, 1997.

percent, from 1,494 in 1991 to 2,127 in 1997, when they comprised 19 percent of China's feed mills.

Table 19 shows the number of feed mills sponsored by other entities. Mills sponsored by the Ministry of Chemicals and the Bureau of Pharmaceuticals produced feed additives such as vitamins, lysine, minerals (sodium phosphate monobasic), and substances to prevent mold in feed and medicines. The number of mills producing feed additives increased over most of the 1990s.

The Ministry of Mechanization presumably established some feed mills to gain practical experience in manufacturing feed milling equipment and in earning profits (sometimes they provided equipment in partnership with other entities). The Ministry of Foreign Trade cooperated with foreign firms in establishing joint venture feed mills, for example, in Shandong province. The number of mills under this Ministry doubled in the 1990s. Military units operate farms and livestock feeding operations to provide food for their own personnel. The number of feed mills sponsored by military units expanded dramatically from 3 in 1991 to 39 in 1997.

Mills with capacity of 5 tons per hour have increased substantially in the last two decades. In 1980, China had only 44 such mills, but by 1985 the number had more than doubled to 110. It rose to 555 by 1990, and increased further to 1,792 in 1998. Ten-ton-per-hour mills first came on line in the mid-1980s, and by 1997 China had 62 such mills.

Mill Management and Ownership

As noted earlier, the state has been a major driving force in developing China's feed industry. State owned and managed mills constituted well over 60 percent of all feed mills at the end of the 1980s. State influence also was strong in collectively owned and managed mills because local government officials oversaw the management of local collective enterprises.

Relatively few mills, perhaps around 5 percent, were privately owned and managed at the end of the 1980s. But by 1997 privately owned mills and public/private joint ventures accounted for 29 percent of all mills (figure 13). Joint venture and foreign-owned firms from Thailand, the United States, Japan, Great Britain, and the regions of Hong Kong and Taiwan, have significantly influenced state and cooperative feed mills by introducing new milling techniques, feed formulas, management methods, and marketing practices. By sharpening competition within the feed sector, the foreign firms and joint ventures created an environment in which both government and cooperative mills had strong incentives to become more efficient.

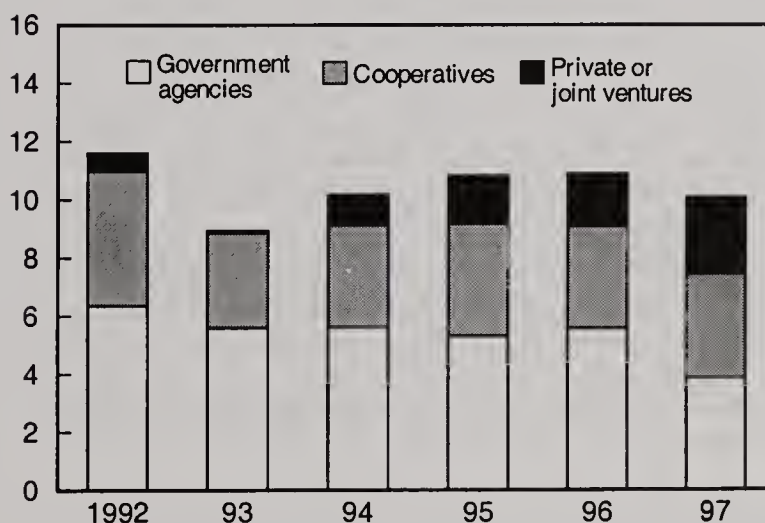
Feed Production and Feed Milling Capacity

China's manufactured feed output increased from practically nothing in 1975 to over 66 million tons in 1998, in parallel with rapid increases in red meat and poultry output (figure 14).

Figure 13

Most mills are owned and managed by government agencies or cooperatives

1,000 mills



Source: China, Ministry of Agriculture, National Feed Industry Office.

Table 19--Feed mills in the "other" category, 1991-97

Year	Ministry of Chemicals	Ministry of Light Industry	Pharmaceutical Bureau	Ministry of Mechanization	Ministry of Foreign Trade	Military	Other
<i>Number</i>							
1991	10	81	4	8	42	3	452
1992	15	33	7	6	37	14	858
1993	48	28	9	5	43	14	913
1994	22	33	9	6	71	24	1,367
1995	70	65	33	19	98	54	1,887
1996	102	87	33	29	89	50	1,753
1997	69	70	16	14	97	39	2,623

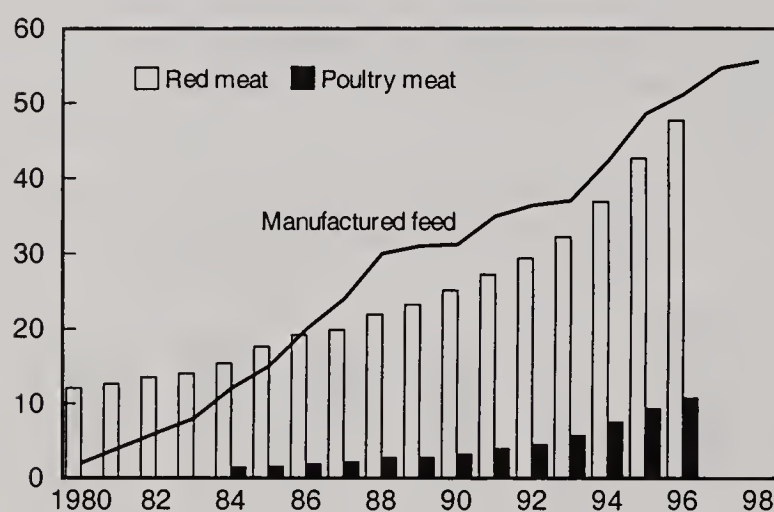
Source: China Feed Industry Statistics Yearbook.

The composition of feed output has changed substantially in the past two decades. Mixed feed was the main form of total feed output in the early 1980s, but by the end of the decade, compound feed accounted for more than half of the total. By 1996, compound feeds accounted for nearly 90 percent of the total, and even the tonnage of mixed feeds was dropping (figure 15). Few concentrate feeds were manufactured in the early 1980s but by 1990 China's feed mills were producing more than half a million tons. This output continued to expand rapidly, reaching 8.9 million tons in 1998. China invested in developing a feed additive industry in the 1980s. At first output grew slowly because China imported many additives that it could not manufacture, or could not manu-

Figure 14

China's manufactured feed output increases with red meat and poultry production

Mil. tons

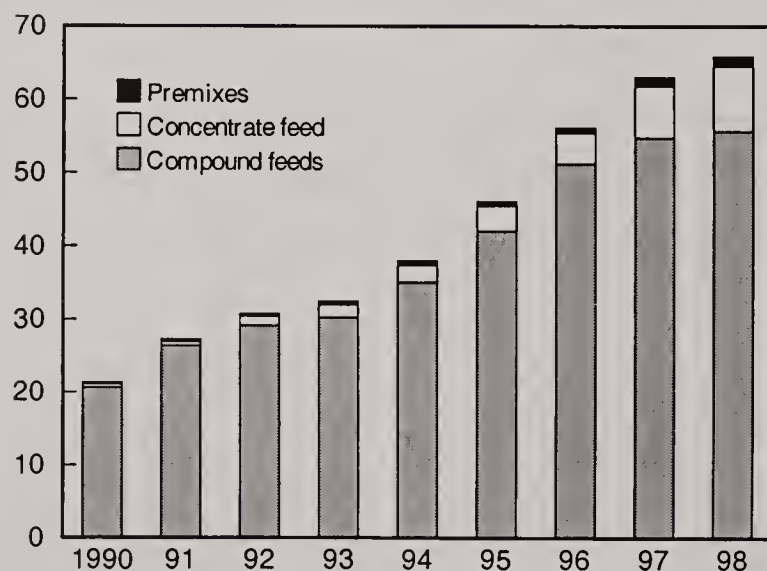


Sources: China, Ministry of Agriculture, National Feed Industry Office and Agricultural Statistical Yearbook.

Figure 15

Feed production grows and diversifies

Mil. tons



Source: China, Ministry of Agriculture, National Feed Industry Office.

facture at a reasonable cost. But in 1990 premix output reached 200,000 tons, and production was nearly 1.4 million tons in 1998.

There is scant information regarding output shares by mill ownership type. It appears that in the early 1980s, Ministry of Commerce (MOC) mills produced most of the compound and mixed feed output. By 1996, the MOC mills' share of output had fallen to about 30 percent. In 1996, most compound and mixed feed was made by MOA, TVE, joint venture, and privately owned mills.

The "1984-2000 feed plan" proposed that China build an industry that could produce 100 to 120 million tons of compound and mixed feeds by the year 2000. In 1997, China produced 56 million tons of compound feed and had an estimated capacity to produce 103 million tons. So in that sense, the country already has attained its long-range target.

Distribution of Compound Feed by Animal Type

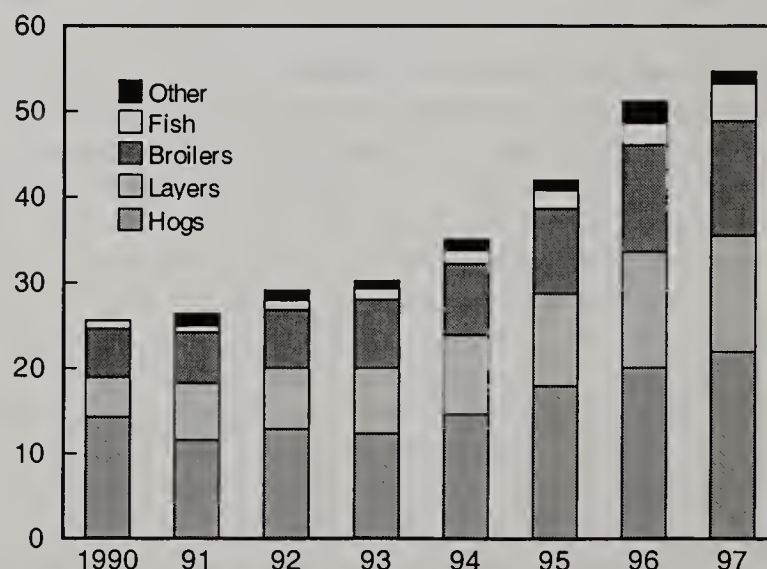
Swine

China is the world's largest hog producer. Pork is the most important meat in the consumer diet and constitutes 67 percent of the country's meat production. In the 1980s, almost all compound and mixed feed went to swine. In 1990, 56 percent of China's compound feed was mixed for hogs, compared with an average of 31 percent in the rest of the world. Since 1990 the percentage of total manufactured feed made for hogs has decreased, although production of hog feeds is still increasing. In 1998, total manufactured compound feeds for hogs reached a record 23.4 million tons, accounting for 42 percent of total compound feeds use (figure 16).

Figure 16

China's feed consumption by animal type

Mil. tons



Source: China, Ministry of Agriculture, National Feed Industry Office.

Feed mills typically are situated in animal producing areas because China's transportation and related infrastructure are poor. Geographically, hog feed manufacturing is concentrated in the central and northern plains of China. In 1997, Hubei replaced Sichuan as the leading producer of manufactured hog feed, with an output of 2.2 million tons. Sichuan, the largest hog producing province, has consistently produced more than 2 million tons of hog feed since 1995.

Poultry

China's poultry industry expanded rapidly in the late 1980s and 1990s. In response, mills stepped up production of compound feed for layers and broilers. Total poultry feed production increased from 10.5 million tons in 1990 to 26.6 million in 1998, and from 40 percent of compound feed production in 1990 to 48 percent in 1998. Mills making feed for layers are concentrated in China's northern plains, while those specializing in broiler feed production are concentrated in coastal areas. Hebei province is the largest layer feed producer with 2.9 million tons of output in 1997, or 21 percent of total layer feed production. Meanwhile, Guangdong led in broiler feed manufacturing with 3.9 million tons, and accounted for 30 percent of total broiler feed output.

Broiler feed costs more than layer and hog feeds because it contains more protein (figure 17). Prices of compound feeds for hogs, layers, and broilers have moved in parallel, without a seasonal pattern, over the past 5 years because they use similar ingredients.

Fish and Aquacultural Products

China has the world's largest freshwater aquaculture industry, which absorbed 6.6 percent of the country's compound feed in 1998, compared with an average of 2 percent in the

rest of the world. Fish feed production was 3.7 million tons in 1998, having grown an average of 18 percent a year since 1990. China's fish feed producing area is concentrated in the Yangtze River Delta, which covers Shanghai and part of Jiangsu and Zhejiang provinces. This area manufactured 41 percent of China's fish feed and produced 24 percent of China's aquacultural output in 1997. China is the world's largest importer of fishmeal, 0.7 million tons in 1998/99, which is used heavily by the aquaculture industry.

Other Animal Feeds

Small quantities of compound feed go to China's ruminant animals. Dairy cows consume around 3 percent of compound feed, compared with an average of 17 percent in the rest of the world. Beef cattle, sheep, and goats get little feed in China, compared with 12 percent in the rest of the world.

Feed Marketing

Feed mills have local feed store outlets or use sales representatives to market their products directly to customers. Privately owned local feed stores carry multiple brands of feed products manufactured by different companies because of the convenience to meet various market demands for different animal feeds. Differences in ingredient composition across brands are minor. However, central location is the most important factor for local feed stores. Sales representatives work with local producers and educate them about the importance of nutrition in commercial livestock feeding. To some degree, feed sales agents have served and replaced a part of the government's farm extension function in explaining feeding technology. Aggressive feed mills conduct training seminars for farmers, pointing out the benefits of a balanced nutritious diet and providing a comprehensive service package with credit terms.

Feed mill agents regularly arrange sales contracts between feed mills and livestock producers. However, with prices for animal products now plummeting, collecting payment due for feed has become a growing problem. Because most farmers lack access to bank credit, those facing financial difficulties are often allowed an extended payment period.

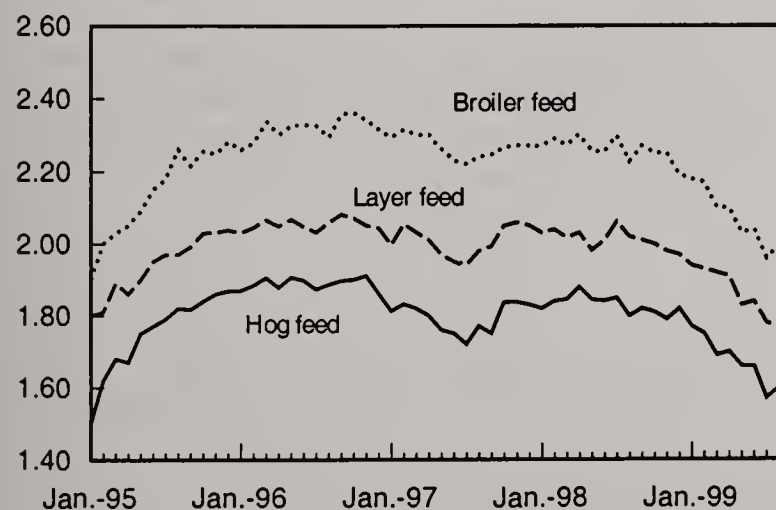
The two leading, nationally distributed feed brands are CP (a joint venture with a Thai feed manufacturer) and the Hope Group (a domestic company with many mills). The combined market share of these two feed companies, however, is still small—probably less than 15 percent in 1998.

Since grain trade businesses are strictly controlled by the state, some joint venture and foreign-owned feed mills have difficulty finding a reliable supplier to procure raw materials. For foreign investors, it takes time to learn how to conduct business in China and to find the appropriate business partners. Most joint ventures started as cooperative ventures with China's grain bureau system, in order to have easy access to domestic grain supplies. Foreign-owned companies usually focus on concentrate and premix production,

Figure 17

Hog and poultry feed prices move in same direction

RMB/kg



Source: China, Ministry of Agriculture.

where the profit margin is higher than for compound feed. Their customers are large private farms that specialize in feeding and corporate livestock operations, as well as small-scale local feed mills. Because of uncertain grain and meal supplies, foreign-owned feed mills seldom market ingredients such as corn or soymeal.

Joint venture and foreign-owned companies have complained about pirated or falsified labels. Shoddy counterfeits hurt the reputation and sales of legitimate mills. A set of new Feed and Feed Additives Regulations that went into effect on June 22, 1999, should help the industry weed out substandard and falsified products.

Feed Quality Standards and Safety

China's State Feed Quality Monitoring and Inspection Center and the Ministry of Agriculture are responsible for feed safety and quality issues and have jointly conducted sample inspections. Since 1987, the two agencies have inspected thousands of feed products. The historical results showed that some feed products failed to meet the state's minimum grade standards, but the overall quality is improving as the percentage of passing grades is slowly rising (table 20). Besides compound feed, the State Feed Quality Monitoring and Inspection Center also sampled and inspected 935 feed additive products in 1995. The passing rate was 77.5 percent.

In 1998, more than 10 percent of manufactured feed failed to meet the state quality standards. The major problem came from regional variations of understanding and interpreting the law and local government enforcement of regulations. For example, passing rates for Xinjiang, Shandong, Jiangsu, Fujian, Hainan, and Henan provinces were 100 percent, while passing rates for Heilongjiang, Qinghai, Shanxi, Yunnan, and Guizhou provinces ranged from 70 to 79 percent. Authorities found that some feed mills were using illegal animal drugs without labeling or use explanations. These residuals became harmful to animal and human health.

Outlook

In 1999, economic difficulties and consumer uncertainty reduced demand for animal products. Meat prices fell, especially for pork. In the first half of 1999, the weak demand for hog feed reduced China's compound feed output an estimated 10 percent.

Despite short-term setbacks, the medium- and long-term outlook for China's feed manufacturing sector remains positive, and with it prospects for greater U.S. exports of feed ingredients. Several factors underlie this optimism.

- ✱ China's economy, hard hit by the Asian financial crisis, now appears to be in the early stages of recovery.
- ✱ In the past decade, the development of China's feed manufacturing sector has paralleled its animal product consumption. China's low per capita meat consumption, even compared with countries with similar average incomes, leaves ample room for growth.
- ✱ China's feed manufacturers are already sophisticated. Alone or in joint ventures with foreign firms, they produce a wide variety of feed types and feed ingredients, including a significant amount of premix and concentrate feeds for farmers to mix on site with locally available grains, protein meals, and fiber. China manufactures milling machinery of export quality, as well as feed. The feed industry has the potential to expand rapidly.
- ✱ The newly implemented Feeds and Feed Additives Regulations, which emphasize labeling, grades and standards, and orderly marketing, will help the industry eliminate substandard or falsified feed products.

For U.S. exporters of oilseeds, oilseed meals, and feed additives, the medium- and long-term prospects remain positive as China's livestock and feed sectors prepare to respond to growing consumer demand. The elimination of the VAT exemption for soymeal will encourage more domestic production of soybean meal and substantially reduce soymeal imports in the near term (see oilseeds in this report). China's

Table 20--Passing rates for inspected feeds in China, 1987, 1990, 1993, 1996, and 1998

Year	----- National sample, all feeds -----		Hog feed	Chicken feed	Duck feed
	Percent passing	Sample size			
1987	20.0	na	0.0	32.1	na
1990	59.7	3,927	na	na	na
1993	75.6	na	73.3	76.7	na
1996	na	na	na	na	71.2
1998	89.7	1,325	89.8	89.1	88.9

na = not available

Source: Zhang, Yu, Situation of Current Feed Industry, State Feed Quality Monitoring and Inspection Center, Beijing, 1999.

protein meal production from domestically grown soybeans is currently about 6 million tons, well short of its estimated demand for 20 to 30 million tons of protein meals annually over the next decade. China's use of soymeal and other protein meals has never been higher, benefiting from near-term low prices and abundant supplies in the world market. China also produces about 1.7 million tons of meal from rapeseed and cottonseed, but toxic components in these products limit their use for feeding animals.

China's production of poultry and aquaculture products, which have high feed conversion rates, is currently only limited by demand—in both domestic and export markets. Pork production will increase at a slower rate as the modernization of this sector progresses more gradually, because small family farms still dominate the swine industry. On family farms, grain and oilseed produced on farm, as well as crop residues and household waste, typically still supply most of the hog feed.

The near-term market prospect for premixes and concentrates is promising. Premixes are used heavily by local feed mills that lack the technology to formulate their own premixes or are unable to maintain expensive inventories of vitamins, minerals, and medicated ingredients. The 65-percent growth in premix production in 1997, compared with the 7-percent growth in total compound feed production, reflected the specialization of China's feed industry. Premixes are increasingly and actively marketed by joint venture and foreign-owned feed companies that specialize in this high-priced, and high margin subsector of the feed industry. In 1998, premix production slowed while total production of concentrates reached 8.9 million tons, up 27 percent from a year earlier.

China may become more willing to import coarse grains too, despite its past emphasis on maintaining grain self-sufficiency. Starting in 2000, China will eliminate price supports for low quality grains, having discovered the enormous cost of storing surpluses.

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Appendix table 1--China's grain area, yield, and production, 1991-98

Item	1991	1992	1993	1994	1995	1996	1997	1998
<i>Million hectares</i>								
Sown area								
Wheat	30.1	30.5	30.2	29.0	28.8	29.6	30.1	29.8
Rice	32.6	32.1	30.4	30.2	30.7	31.4	31.8	31.2
Corn	21.6	21.0	20.7	21.2	22.8	24.5	23.8	25.2
Sorghum	1.4	1.3	1.3	1.4	1.2	1.3	1.1	na
Millet	2.1	1.9	1.8	1.7	1.5	1.5	1.4	na
Tubers	9.1	9.1	9.2	9.3	9.5	9.8	9.8	10.0
Others 1/	15.5	14.7	16.8	16.9	15.3	14.3	14.9	na
Total grains 2/	112.3	110.6	110.5	109.5	109.9	112.4	112.9	113.8
<i>Tons/hectare</i>								
Yield 3/								
Wheat	3.2	3.3	3.5	3.4	3.5	3.7	4.1	3.7
Rice	5.6	5.8	5.9	5.8	6.0	6.2	6.3	6.4
Corn	4.6	4.5	5.0	4.7	4.9	5.2	4.4	5.3
Sorghum	3.5	3.6	4.1	4.6	3.9	4.4	3.3	na
Millet	1.6	2.1	2.2	2.2	2.0	2.3	1.6	na
Tubers	3.0	3.1	3.5	3.3	3.4	3.6	3.3	3.6
<i>Million tons</i>								
Production								
Wheat	96.0	101.6	106.4	99.3	102.0	110.6	123.3	109.7
Rice	183.8	186.2	177.7	175.9	185.2	195.1	200.7	198.7
Corn	98.8	95.4	102.7	99.3	112.0	127.5	104.3	133.0
Sorghum	4.9	4.7	5.5	6.3	4.8	5.7	3.6	na
Millet	3.4	3.9	4.0	3.7	3.0	3.3	2.3	na
Tubers 4/	27.2	28.4	31.8	30.3	32.1	35.4	31.9	36.0
Others 1/	21.3	22.4	28.3	30.3	27.5	27.0	28.1	na
Total grains 2/	435.3	442.7	456.4	445.1	466.6	504.5	494.2	512.3

na = not available

1/ Consists of soybeans, pulses, and other miscellaneous grains. All of these items are included in China's definition of total grains.

2/ Using China's definition of total grains.

3/ Calculated from area and production figures.

4/ Converted to a grain-equivalent weight using a 5:1 conversion ratio.

Sources: *China Agriculture Yearbook*, *China Statistical Yearbook*, and *China Statistics Abstract*.

Appendix table 2--China's 1998 grain, cotton, oilseed, sugar, and red meat production, by province

Region Province	Grain 1/	Cotton	Oilseeds	Sugar	Red meat
			1,000 tons		
Northeast					
Heilongjiang	31,045	--	181.9	4,477.0	1,090
Liaoning	13,135	15.1	160.7	400.7	1,269
Jilin	18,083	--	159.3	329.0	832
North					
Shandong	38,522	353.9	2,409.4	14.6	2,578
Hebei	27,467	248.7	1,179.8	70.9	2,731
Beijing	2,375	2.2	27.3	--	278
Tianjin	2,062	3.9	30.1	--	153
Henan	38,947	790.0	2,766.6	172.7	3,462
Shanxi	9,014	44.4	280.5	668.4	516
Northwest					
Shaanxi	10,444	20.6	367.1	34.3	751
Gansu	7,662	33.8	355.6	1,391.1	493
Nei Monggol	14,210	0.5	731.3	3,063.9	1,138
Ningxia	2,566	--	62.2	598.0	118
Xinjiang	8,300	1,150.0	299.5	3,887.1	556
Qinghai	1,276	--	183.6	0.2	196
East					
Zhejiang	14,935	47.6	488.8	600.2	813
Jiangsu	35,638	507.5	1,419.3	233.4	1,864
Shanghai	2,302	3.8	106.7	61.5	242
Anhui	28,027	301.0	2,050.1	199.3	1,989
Central					
Hubei	26,344	580.9	1,954.7	1,009.0	2,189
Hunan	28,019	255.7	1,292.6	1,745.3	3,299
Jiangxi	17,677	132.4	1,056.3	2,205.9	1,701
South					
Guangdong	18,977	--	754.6	17,642.8	1,799
Guangxi	15,448	1.2	555.2	32,423.8	2,002
Fujian	9,618	--	243.6	2,499.0	1,070
Hainan	2,139	--	84.2	3,775.0	211
Southwest					
Chongqing	11,577	0.5	233.4	80.8	1,245
Sichuan	34,613	107.3	1,341.6	1,558.0	3,691
Guizhou	10,259	0.9	589.7	370.8	1,007
Yunnan	12,719	0.7	174.3	14,351.8	1,490
Xizang	773	--	33.7	--	122
National total	494,173	4,602.6	21,573.7	93,864.5	40,895

-- = none or negligible

1/ Using China's definition of total grains. See Appendix table 1.

Source: *China Rural Statistical Yearbook*.

Appendix table 3--China's cotton and oilseed area, yield, and production, 1990-98

Item	1990	1991	1992	1993	1994	1995	1996	1997	1998
Sown area <i>1,000 hectares</i>									
Cotton	5,588	6,538	6,835	4,985	5,530	5,422	4,722	4,491	4,459
Soybeans	7,560	7,050	7,221	9,700	10,000	8,127	7,471	8,346	8,500
Oilseeds 1/	10,900	11,530	11,489	11,142	12,081	13,101	12,555	12,381	12,919
Peanuts	2,907	2,880	2,976	3,379	3,776	3,809	3,616	3,722	4,039
Rapeseed	5,503	6,133	5,976	5,300	5,783	6,907	6,734	6,475	6,527
Sesameseed	669	680	746	753	690	642	594	616	630
Sunflowerseed	713	750	807	723	805	813	690	716	890
Miscellaneous 2/	1,108	1,087	984	987	1,033	930	921	852	833
Yield <i>Kg/hectare</i>									
Cotton	807	869	660	750	780	879	890	1,025	830
Cottonseed	1,372	1,478	1,121	1,278	1,393	1,582	1,601	1,844	1,817
Soybeans	1,455	1,377	1,426	1,578	1,600	1,661	1,770	1,765	1,783
Oilseeds 1/	1,480	1,421	1,428	1,619	1,647	1,717	1,761	1,743	1,791
Peanuts	2,191	2,189	2,000	2,492	2,564	2,687	2,804	2,592	2,943
Rapeseed	1,264	1,212	1,281	1,309	1,296	1,416	1,366	1,479	1,272
Sesameseed	701	640	692	747	794	908	968	919	1,041
Sunflowerseed	1,879	1,467	1,820	1,770	1,880	1,561	1,917	1,642	1,646
Miscellaneous 2/	901	729	831	845	660	684	944	711	999
Production <i>1,000 tons</i>									
Cotton (1,000 tons) 3/	4,508	5,675	4,508	3,739	4,333	4,768	4,203	4,603	4,501
Cotton (1,000 bales) 3/	20,705	26,065	20,705	17,175	19,901	21,899	19,304	21,142	20,673
Cottonseed	7,665	9,660	7,664	6,370	7,704	8,580	7,560	8,280	8,100
Soybeans	11,000	9,710	10,300	15,310	16,000	13,500	13,220	14,730	15,152
Oilseeds 1/	16,132	16,383	16,412	18,039	19,896	22,500	22,106	21,574	23,139
Peanuts	6,368	6,300	5,953	8,421	9,682	10,235	10,138	9,648	11,886
Rapeseed	6,958	7,436	7,653	6,939	7,492	9,777	9,201	9,578	8,300
Sesameseed	469	435	516	563	548	583	575	566	656
Sunflowerseed	1,339	1,420	1,472	1,282	1,500	1,269	1,323	1,176	1,465
Miscellaneous 2/	998	792	818	834	682	636	869	606	832
Edible vegetable oil 4/	4,454	4,868	4,813	5,307	6,145	6,800	6,840	7,465	7,987
Available meal	11,915	12,553	12,825	15,057	17,159	17,664	17,976	20,047	20,525

na = not available

1/ Using China's definition of oilseeds, which excludes soybeans and cottonseed.

2/ Calculated as a residual. Includes mainly huma (an edible-oil bearing flaxseed) and castor beans, but excludes oil-bearing tree seeds.

3/ Cotton production is on a ginned-weight basis. One bale weighs 480 pounds.

4/ Includes soy, cottonseed, peanut, rapeseed, and sunflowerseed oils.

Sources: *China Statistical Yearbook*, except USDA/ERS *Time Series Data* for edible vegetable oil and available meal.

Appendix table 4—China's yearend livestock inventory and livestock product output, 1991-98

Item	----- Old data series -----					----- Revised data series 1/ -----		
	1991	1992	1993	1994	1995	1996	1997	1998
Year-end inventory								
	<i>Million head</i>							
Hogs	369.7	384.2	393.0	414.6	441.7	362.8	400.3	422.6
Sheep	110.9	109.7	111.6	117.5	127.3	114.1	120.9	127.2
Goats	95.4	97.6	105.7	123.1	149.6	123.2	134.8	141.7
Large animals	131.9	134.7	139.9	149.2	158.6	133.6	145.4	148.0
Cattle	104.6	107.8	113.2	123.3	132.1	110.3	121.8	124.4
Dairy cows	3.0	3.1	3.4	3.8	4.2	3.3	na	na
Water buffalo	22.0	22.2	22.6	22.9	23.6	21.7	22.2	na
Horses	10.1	10.0	10.0	10.0	10.1	8.7	8.9	9.0
Mules	5.6	5.6	5.5	5.6	5.4	4.8	4.8	4.7
Donkeys	11.2	11.0	10.9	10.9	10.8	9.4	9.5	9.5
Camels	0.4	0.4	0.4	0.4	0.4	0.3	0.4	0.3
Draft animals 2/	76.8	77.6	80.6	84.6	88.1	73.8	77.2	na
Slaughter								
Hogs	329.0	351.7	378.2	421.0	480.5	412.3	464.8	502.2
Cattle	13.0	15.2	19.0	25.1	30.5	26.9	32.8	35.9
Sheep & goats	98.2	102.7	111.5	131.3	165.4	134.1	159.5	172.8
Slaughter rate								
	<i>Percent of previous year's ending stock</i>							
Hogs	90.8	95.1	98.4	107.1	115.9	NA	128.1	125.5
Cattle	12.7	14.5	17.6	22.2	24.7	NA	29.7	29.5
Sheep & goats	46.7	49.8	53.8	60.4	68.7	NA	67.2	67.6
Animal products								
	<i>1,000 tons</i>							
Red meat	27,238	29,406	32,255	36,927	42,653	36,947	42,499	45,982
Pork	24,523	26,353	28,544	32,048	36,484	31,580	35,963	38,837
Beef	1,535	1,803	2,337	3,270	4,154	3,557	4,409	4,799
Mutton	1,180	1,250	1,374	1,607	2,015	1,810	2,128	2,346
Poultry meat 3/	3,950	4,542	5,736	7,552	9,347	na	na	na
Eggs 3/	9,220	10,199	11,796	14,790	16,767	19,652	18,953	20,185
Cow milk	4,644	5,031	4,987	5,288	5,764	6,294	6,011	6,621
Sheep & goat milk	599	608	647	801	964	1,064	800	824
Sheep wool	240	238	240	255	277	298	255	277
Mohair	17	17	19	25	30	35	26	31
Cashmere	6	6	7	7	9	10	10	10

na = not available NA = Not Applicable (ratio to previous year's stock is meaningless, due to data revision)

1/ All data series were revised, based on China's 1997 Agricultural Census.

2/ Composed of large animals (portion of stock used as draft animals varies by species).

3/ Includes chickens, duck, and goose meat or eggs.

Sources: *China Statistical Yearbook*, *China Agricultural Yearbook*, and *China Statistics Abstract*.

Appendix table 5--Volume of China's major agricultural exports, 1994-98

Item	Units	1994	1995	1996	1997	1998
Animals and animal products						
Swine, live	1,000 head	2,700	2,530	2,400	2,270	2,190
Poultry, live	1,000 head	52,300	52,630	53,773	52,675	42,616
Beef, frozen	1,000 tons	20	20	29	31	43
Pork, fresh or frozen	1,000 tons	100	150	129	103	104
Broilers, frozen	1,000 tons	164	249	297	291	268
Rabbit meat, frozen	1,000 tons	27	48	24	29	15
Eggs	Million eggs	486	358	709	948	864
Natural honey	1,000 tons	102	87	83	48	79
Raw silk	1,000 tons	13	13	12	11	9
Furskins, raw	1,000 pieces	na	na	144	206	190
Rabbit hair	1,000 tons	11	4	4	4	3
Grain						
Rice	1,000 tons	1,520	50	265	939	3,746
Corn (maize)	1,000 tons	8,740	110	159	6,597	4,687
Oilseeds and vegetable oil						
Edible oilseeds	1,000 tons	1,490	910	690	410	440
Soybeans	1,000 tons	830	380	192	186	170
Peanuts, shelled and unshelled	1,000 tons	480	390	351	170	216
Vegetable oil	1,000 tons	270	517	473	823	309
Fruits and tree nuts						
Oranges	1,000 tons	127	132	151	209	161
Apples	1,000 tons	107	109	165	188	170
Walnuts, in shell	1,000 tons	na	na	2	1	1
Walnut meat	1,000 tons	11	9	13	13	10
Chestnuts	1,000 tons	38	36	32	32	39
Miscellaneous crops						
Dry beans	1,000 tons	na	na	547	595	472
Sugar	1,000 tons	947	480	642	365	423
Tea	1,000 tons	180	167	170	202	217
Flue-cured tobacco	1,000 tons	59	57	52	70	86
Cotton	1,000 tons	108	22	4	1	45
Manufactured products						
Canned pork	1,000 tons	69	64	42	37	33
Canned mushrooms	1,000 tons	na	na	175	154	145
Beer	Million liters	110	131	67	72	56
Cotton yarn	1,000 tons	195	180	142	153	133

na = not available

Sources: *China Customs Statistics* and *China Monthly Exports and Imports*, December issues.

Appendix table 6--Value of China's major agricultural exports, 1994-98

Item	1994	1995	1996	1997	1998
<i>U.S. \$ million</i>					
Animals and animal products					
Swine, live	269	278	294	302	291
Poultry, live	105	125	121	114	96
Beef, frozen	31	34	51	54	73
Pork, fresh or frozen	128	245	215	195	180
Broilers, frozen	343	557	629	548	452
Rabbit meat, frozen	40	48	65	64	27
Eggs	18	17	41	41	33
Natural honey	75	87	111	65	83
Raw silk	295	301	264	274	213
Furskins, raw	4	3	5	14	9
Rabbit hair	137	71	68	81	40
Grain					
Rice	515	16	112	265	927
Corn (maize)	944	13	30	856	532
Oilseeds and vegetable oil					
Edible oilseeds excl. soybeans	635	494	452	262	270
Soybeans	222	100	66	73	63
Peanuts, shelled and unshelled	315	257	254	137	156
Vegetable oil	209	407	319	548	225
Fruits and tree nuts					
Citrus 1/	54	56	67	76	48
Apples	41	45	69	77	65
Walnuts, in shell	na	na	2	2	2
Walnut meat	27	25	38	37	28
Chestnuts	80	77	66	64	69
Miscellaneous crops					
Dry beans	na	na	248	267	217
Sugar	321	187	248	133	123
Tea	294	275	283	332	370
Flue-cured tobacco	72	77	90	170	164
Cotton	149	47	12	3	56
Manufactured products					
Canned pork	110	119	72	66	59
Canned mushrooms	na	na	201	159	146
Beer	41	53	32	34	26
Cotton yarn	514	576	459	485	421

na = not available

1/ Includes oranges and other citrus fruits.

Sources: *China Customs Statistics* and *China Monthly Exports and Imports*, December issues.

Appendix table 7--Volume of China's major agricultural imports, 1994-98

Item	Units	1994	1995	1996	1997	1998
Grain	1,000 tons	9,040	20,400	10,830	4,170	3,880
Wheat	1,000 tons	7,180	11,590	8,246	1,860	1,489
Barley	1,000 tons	510	na	1,308	1,874	1,519
Rice	1,000 tons	0	1,640	761	326	244
Corn (maize)	1,000 tons	30	5,180	441	0	250
Oilseeds, oils, and fats						
Soybeans	1,000 tons	na	294	1,108	2,876	3,189
Edible vegetable oil	1,000 tons	1,630	3,530	2,640	2,750	2,060
Other vegetable oil	1,000 tons	1,580	200	120	110	130
Animal oils and fats	1,000 tons	na	na	208	207	184
Miscellaneous agric. products						
Dry beans	1,000 tons	na	na	na	125	na
Sugar	1,000 tons	1,550	2,950	1,255	799	508
Coffee	1,000 tons	na	na	12	2	5
Cocoa beans	1,000 tons	na	na	33	37	26
Cotton	1,000 tons	500	740	651	749	196
Wool	1,000 tons	319	284	226	789	169
Logs	1,000 cu. meters	3,330	2,580	3,185	4,471	4,810
Natural rubber	1,000 tons	340	320	553	423	430
Synthetic rubber 1/	1,000 tons	251	311	368	451	474
Inputs to agriculture						
Fertilizer, manufactured	1,000 tons	12,660	19,910	18,568	16,489	13,923
Urea	1,000 tons	3,130	6,960	6,010	3,420	119
Potassium chloride	1,000 tons	2,850	3,860	3,440	4,630	5,118
Compound fertilizer	1,000 tons	5,140	7,300	7,210	7,490	8,050
Pesticides	1,000 tons	32	35	32	49	44

na = not available

1/ Not an agricultural product, but included for comparison to imports of natural rubber.

Sources: *China Customs Statistics* and *China Monthly Exports and Imports*, December issues.

Appendix table 8--Value of China's major agricultural imports, 1994-98

Item	1994	1995	1996	1997	1998
<i>U.S. \$ million</i>					
Grain	1,273	3,607	2,575	916	716
Wheat	943	2,026	1,890	368	279
Barley	na	na	304	382	241
Rice	141	434	286	138	120
Corn (maize)	0	816	73	0	32
Oilseeds, oils, and fats					
Soybeans	na	na	320	843	804
Edible vegetable oil	986	2,316	1,493	1,505	1,299
Other vegetable oil	758	116	78	68	85
Animal oils and fats	na	na	103	88	87
Miscellaneous agricultural products					
Dry beans	na	na	51	31	22
Sugar	408	898	393	229	177
Coffee	na	na	2	na	11
Cocoa beans	na	na	42	48	44
Cotton	880	1,378	1,196	1,330	332
Wool	794	944	851	789	603
Logs	430	368	458	678	597
Natural rubber	331	422	722	449	320
Synthetic rubber 1/	251	327	397	466	467
Inputs to agriculture					
Fertilizer, manufactured	1,938	3,742	3,563	2,995	2,518
Urea	423	1,427	1,242	619	17
Potassium chloride	306	438	387	532	606
Compound fertilizer	972	1,617	1,661	1,678	1,762
Pesticides	137	160	138	166	186

na = not available

1/ Not an agricultural product, but included for comparison to imports of natural rubber.

Source: *China Customs Statistics*.

Appendix table 9--U.S. exports of agricultural, fish, and forestry products to China, 1993-99

Product	1993	1994	1995	1996	1997	1998	1999
	\$1,000						
Bulk agricultural total	297,430	826,211	2,026,726	1,588,091	1,047,396	503,897	430,949
Wheat	274,186	166,228	499,791	426,381	43,647	45,971	32,877
Coarse grains	0	3,510	638,278	13,842	31	44,143	15,441
Rice	15	136	63	471	202	289	406
Soybeans	22,999	8,645	50,657	414,476	410,554	273,508	347,843
Cotton	179	646,935	836,657	730,456	582,670	126,284	23,816
Tobacco	0	0	767	250	2,342	6,437	4,508
Pulses	28	92	123	31	43	131	182
Peanuts	0	60	6	0	3	14	0
Other bulk commodities	22	603	383	2,184	7,904	7,119	5,875
Intermediate agricultural total	39,787	208,933	540,205	387,831	430,292	700,527	271,976
Wheat flour	0	0	14	110	10	0	32
Soybean meal	29	0	76	116,700	84,429	159,541	304
Soybean oil	270	104,192	341,264	104,467	161,895	311,618	52,291
Vegetable oils (excl. soybean oil)	93	27,087	13,842	4,714	452	1,622	3,746
Feeds and fodders (excl. pet foods)	978	2,790	8,142	8,441	10,080	13,496	6,920
Live animals	7,976	9,014	10,096	10,576	7,665	5,962	6,737
Hides and skins	13,077	46,272	100,145	106,640	111,905	124,965	96,141
Animal fats	3	2,397	39,178	2,686	3,103	3,831	14,724
Planting seeds	1,370	969	10,671	2,837	8,174	10,239	13,836
Sugars, sweeteners, and beverage bases	2,386	792	931	1,142	1,394	1,142	951
Other intermediate products	13,604	15,420	15,846	29,518	41,184	68,111	76,292
Consumer-oriented agricultural total	36,678	48,643	67,166	105,990	125,250	131,650	147,676
Snack foods (excl. nuts)	2,956	6,871	7,289	6,806	11,979	8,652	12,665
Breakfast cereals and pancake mix	7	45	289	1,554	1,598	524	323
Red meats, fresh/chilled/frozen	1,828	3,922	4,674	5,488	11,257	15,399	15,113
Red meats, prepared/preserved	126	101	239	616	1,047	2,918	1,125
Poultry meat	17,569	23,584	33,892	60,345	52,413	38,460	49,134
Dairy products	565	1,716	5,111	4,560	11,296	13,931	17,744
Eggs and products	158	22	61	76	195	139	343
Fresh fruit	238	636	2,169	683	887	11,319	1,880
Fresh vegetables	13	365	297	1,428	2,728	3,637	3,765
Processed fruit and vegetables	919	1,386	1,695	4,686	6,780	9,321	15,606
Fruit and vegetable juices	512	246	826	514	711	1,490	1,734
Tree nuts	7,272	4,065	250	2,190	2,367	2,337	3,507
Wine and beer	560	478	2,998	1,958	3,158	2,404	3,826
Nursery products and cut flowers	45	130	90	125	1,785	998	1,303
Pet foods (dog and cat food)	8	93	124	183	133	490	977
Other consumer-oriented products	3,900	4,983	7,161	14,779	16,915	19,632	18,631
Forest products (excl. pulp and paper)	106,277	64,065	28,006	32,010	49,850	41,565	56,885
Logs and chips	97,605	56,157	13,915	11,041	13,890	11,354	7,860
Hardwood lumber	1,574	1,855	5,851	9,136	16,901	13,956	29,881
Softwood and treated lumber	398	456	358	627	1,737	1,318	1,213
Panel products (incl. plywood)	1,304	1,991	4,662	3,891	4,863	6,339	9,888
Other value-added wood products	5,395	3,606	3,220	7,316	12,459	8,598	8,043
Fish and seafood products, edible	27,629	43,010	71,632	78,587	111,486	68,614	87,145
Salmon, whole or eviscerated	837	1,941	4,297	3,182	2,513	9,735	8,234
Salmon, canned	0	0	0	0	0	0	102
Crab and crabmeat	20,030	18,973	4,823	5,979	3,187	4,996	20,230
Surime (fish paste)	610	324	1,110	1,061	7,165	2,738	431
Roe and urchins (fish eggs)	397	166	609	3,344	2,326	4,954	4,164
Other edible fish and seafood	5,754	21,607	60,794	65,021	96,294	46,190	53,984
Agricultural product total	373,894	1,083,786	2,634,097	2,081,911	1,602,937	1,336,074	850,601
Agricultural, fish, and forestry total	507,800	1,190,861	2,733,735	2,192,508	1,764,274	1,446,253	994,631

Source: U.S. Bureau of the Census Trade data

Appendix table 10--U.S. Imports of agricultural, fish, and forestry products from China, 1993-99

Product	1993	1994	1995	1996	1997	1998	1999
	\$1,000						
Bulk agricultural total	74,783	52,551	50,100	49,419	51,561	56,592	82,574
Coarse grains	43	55	96	69	39	50	27
Rice	33	2,290	422	403	552	283	9,344
Tobacco	37,978	7,238	2,461	6,494	9,192	11,381	10,661
Rubber and allied products	81	1,779	10,400	401	556	473	723
Raw coffee	16	56	747	6	802	197	418
Cocoa beans	0	278	192	0	0	0	0
Tea (incl. herb tea)	27,702	29,533	24,917	31,260	28,156	33,121	26,492
Raw beet and cane sugar	81	183	348	96	153	421	278
Other bulk commodities	8,847	11,139	10,516	10,689	12,112	10,666	34,631
Intermediate agricultural total	160,217	176,631	205,369	242,317	306,520	348,452	314,833
Tropical oils	0	0	0	0	115	11	0
Other vegetable oils	1,816	2,155	1,397	5,194	6,433	7,703	5,067
Feeds and fodders (excl. pet foods)	1,324	2,502	4,285	4,686	11,734	8,009	8,375
Live animals	34	2	13	31	2	0	45
Hides and skins	223	276	115	122	79	172	153
Planting seeds	11,742	14,899	16,916	23,027	27,103	25,750	23,155
Sugars, sweeteners, and beverage bases	643	955	1,600	2,404	3,493	5,638	3,301
Essential oils	20,413	25,187	29,235	21,607	17,217	25,123	26,084
Cocoa paste and cocoa butter	30,024	23,676	24,311	36,104	49,364	33,055	21,034
Other intermediate products	93,998	106,980	127,497	149,141	190,980	242,990	227,620
Consumer-oriented agricultural total	216,111	213,223	234,136	298,773	319,029	332,593	364,778
Snack foods (incl. chocolate)	6,183	8,723	7,849	10,226	14,402	15,834	23,629
Red meats, fresh/chilled/frozen	1,389	544	1,183	1,135	1,590	1,319	2,350
Red meats, prepared/preserved	50	12	51	27	105	164	312
Cheese	0	71	0	0	0	0	0
Other dairy products	300	121	287	245	81	375	411
Other fresh fruit	30	111	68	69	201	840	2,493
Fresh vegetables	17,877	11,724	8,521	11,180	14,025	18,840	15,421
Processed fruit and vegetables	96,060	104,607	133,583	161,748	160,137	155,728	154,554
Fruit and vegetable juices	1,279	1,232	3,067	8,285	26,128	30,083	24,412
Tree nuts	21,209	14,446	10,910	19,077	19,324	22,876	29,686
Wine and beer	7,261	4,944	6,918	5,545	6,514	6,388	6,639
Nursery products and cut flowers	848	1,067	935	1,620	1,551	1,806	3,377
Roasted and instant coffee	191	1,160	555	9	516	227	406
Spices	10,911	15,800	13,569	11,701	14,334	17,637	21,965
Other consumer-oriented products	52,522	48,661	46,640	67,906	60,121	60,475	79,125
Forest products (excl. pulp and paper)	150,881	194,547	226,366	258,250	340,066	459,584	596,740
Logs and chips	45	12	36	71	0	0	60
Hardwood lumber	79	61	739	1,040	1,129	926	2,347
Softwood and treated lumber	0	17	113	2	118	211	124
Panel products (incl. plywood)	8,018	7,748	7,857	5,933	14,359	21,843	29,673
Other value-added wood products	142,739	186,708	217,622	251,204	324,460	436,604	564,535
Fish and seafood products, edible	298,799	259,026	305,763	285,303	320,904	322,827	430,754
Shrimp	183,983	105,381	79,578	35,772	67,801	36,041	49,938
Tuna	136	467	499	55	44	969	909
Lobster	815	2,620	15,710	6,971	908	567	328
Groundfish, fillet/steak	45,317	43,860	70,172	92,080	85,663	118,176	138,764
Salmon, whole or eviscerated	0	54	0	1	21	481	680
Other edible fish and seafood	68,548	106,644	139,804	150,424	166,467	166,594	240,136
Agricultural product total	451,111	442,406	489,605	590,509	677,110	737,637	762,185
Agricultural, fish, and forestry total	900,791	895,978	1,021,734	1,134,061	1,338,080	1,520,048	1,789,679

Source: U.S. Bureau of the Census Trade Data.

Appendix table 11--China's other agricultural output, 1990-98

Items	1990	1991	1992	1993	1994	1995	1996	1997	1998
<i>1,000 tons</i>									
Sugar crops	72,145	84,187	88,080	76,240	73,452	79,401	83,599	93,870	97,900
Sugarcane	57,620	67,898	73,011	64,194	60,926	65,417	66,873	78,900	83,430
Sugarbeets	14,525	16,289	15,069	12,048	12,526	13,984	16,726	14,970	14,470
Tobacco	2,627	3,031	3,499	3,451	2,238	2,314	3,234	4,251	2,364
Flue-cured	2,259	2,670	3,119	3,036	1,940	2,072	2,946	3,908	2,088
Fruit	18,744	21,761	24,400	30,112	34,992	42,114	46,528	50,893	54,529
Tea	540	542	560	600	588	588	593	613	665
Jute and hemp 1/	726	513	619	672	354	371	365	430	248
Rubber	264	296	309	326	374	424	402	452	440
Silk cocoons	534	584	660	756	844	760	508	469	526
Aquaculture products	12,370	13,510	15,570	18,230	21,430	25,250	32,880	36,020	39,060

1/ Hemp data are on a processed basis (2 kg raw equals 1 kg processed).

Source: *China Statistical Yearbook*.

Appendix table 12--China's exchange rates, 1990-99

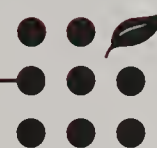
Year	Exchange rate
<i>Yuan/\$US</i>	
1990	4.783
1991	5.323
1992	5.515
1993	5.762
1994	8.619
1995	8.351
1996	8.314
1997	8.290
1998	8.279
1999	8.278

Source: *International Financial Statistics*.

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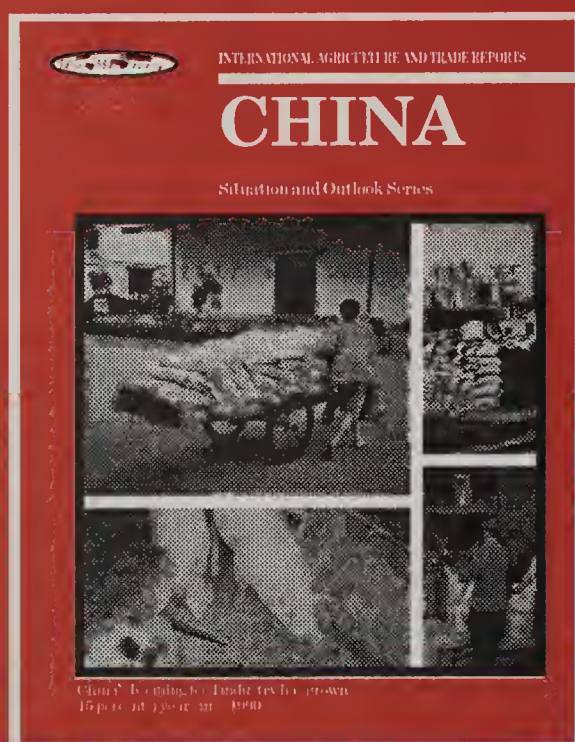
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